B.C.HYDRO

MURPHY CREEK PROJECT

CAMP AND OFFICE DEVELOPMENT STUDY

PRELIMINARY DESIGN REPORT

MARCH, 1983

Bowman
Engineering
Associates
Limited

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SECTION 1.0 - INTRODUCTION

1.1 GENERAL

The camp and office development study has been conducted in two phases, the first covering the process of site identification and selection, and the second, the detailed preliminary design for the selected site. The first phase work has been summarized in this report as Section 2.0 - Site Selection.

A summary of the first phase work was used by B.C. Hydro to present the alternative sites under consideration to the public. The resulting dialogue with the public lead to the selection of a site for the camp and office development downstream from the proposed project site and immediately upstream of the confluence of Hanna Creek and the Columbia River.

This site, identified in Section 2.0 as Site I, is the subject of the preliminary design presented in Section 3.0 of this report.

1.2 TERMS OF REFERENCE

The terms of reference prepared by B.C. Hydro in the request for proposals for this study are as follows:

Terms of Reference

(a) Scope

1. The Consultant should select a location for the camp and office development and work areas on the right bank of the

Columbia River and outside the limits of the future reservoir. The development shall be close to the project site and may be split up into different areas. Close coordination with B.C. Hydro and with local groups as specified by B.C. Hydro, should be maintained during the location selection process.

2. The Consultant should determine the location and nature of existing services in the area of the proposed location of the camp and office development.

3. The Consultant shall undertake investigations and prepare preliminary designs and cost estimates for:

   a. A single labour camp including bunkhouses, kitchens, recreational areas and services including power, domestic and fire water, gas, sewer and telephone. The camp should provide accommodation for a maximum of 500 persons during Years 1 to 3 of construction, with provision for expansion to accommodate 800 persons for Year 4. The kitchen facilities should provide service for an additional 200 persons. The design shall meet the standards set by the B.C. and Yukon Territory Building and Construction Council Camp Rules and Regulations 1979-1987.

   b. B.C. Hydro's project office complex, including all required services. The design shall include an office building for B.C. Hydro, an office building for the contractors, a vehicle maintenance garage, warehouse soils laboratory, and provision for expansion.

4. The Consultant should retain the services of an Architect for advice on building and area layout and landscaping.

5. The Consultant should review possible measures which could be incorporated in the development at no extra cost, which could provide mitigation or long term use potential.

6. The Consultant should identify and incorporate into the design any municipal, provincial or federal regulations or by-laws covering this development.

7. The Consultant should prepare reports based on the studies outlined above including plans showing layout of structures and services, schedules and detailed cost estimates. This report will be used by B.C. Hydro in their project planning and for their Energy Project Certificate application.

(b) Conditions

1. Road and rail access to the perimeter of the camp and to the office complex will be provided by B.C. Hydro. Design of vehicle routes, parking facilities and railway sidings within those areas shall be the responsibility of the Consultant.

2. B.C. Hydro will arrange for electical power to the perimeter of the camp and office complex areas, at primary distribution voltage. Preliminary design of distribution facilities beyond the terminal pole(s) shall be the responsibility of the Consultant.

(c) Schedule

The Consultant shall complete the work described, up to preparation of the final draft report, within 3 months of the date of execution of an Agreement (or acceptance of a relevant Purchase Order)."

These terms of reference were subsequently modified by a letter dated 20 January 1982 which amended scope, Item 3a. as follows:

A single labour camp including bunkhouses, kitchens, recreational areas and services including power, domestic and fire water, gas, sewer and telephone. The camp should provide accommodation for a maximum of 450 persons during Years 1 and 2 of construction, with provision for expansions to accommodate 600 persons for Year 3. The kitchen facilities should provide service for an additional 200 persons. The design shall meet the standards set by the B.C. and Yukon Territory Building and Construction Council Camp Rules and Regulations 1979-1987.

1.3 SITE SELECTION

The site selection phase of the study identified six potential sites of which three, Site I - Damsite, Site II - Oasis Road and Site III - Murphy Creek, rated very closely as the most favourable choices. All the choices were presented to the public through the Project Impact Committee (PIC) at a public meeting. At this meeting the public was asked to comment on the sites identified and to express their preferences through a questionnaire.

The consensus of the meeting confirmed by the results of the questionnaire indicated a preference for Site I - Damsite, as it was felt that the camp would act as a buffer to construction activity at the dam itself. After further discussion with the PIC and the Consultants, a consensus was reached to proceed with preliminary design for Site I. This decision was endorsed by the PIC and was published in the local media.

1.4 PRELIMINARY DESIGN

Following the decision to select Site I - Damsite, for the camp and office development, a number of alternative layouts for the camp and other facilities were prepared before proceeding with the design presented in Section 3.0 of this report. All the layouts separated the residential from the operating functions by means of recontoured land forms.

The proposed design eliminated a number of facilities and proposed two-storey bunkhouses to conserve space. The facilities were laid out to isolate the residential parts of the camp from direct construction activity by using the administration and service areas as a buffer. In this way, the quiet zones of the camp would also serve as a buffer to mitigate camp impacts on the neighbouring communities of Rivervale and Oasis.

The preliminary design includes site planning of buildings, roads and parking, with grading proposals; preliminary design of trunk and distribution services for water supply, sewage disposal and stormwater drainage; schematic designs for natural gas and electric power supply, including site lighting, and landscaping proposals. These designs are illustrated by appropriate drawings and are supported by preliminary cost estimates in 1982 dollars.

SECTION 2.0 - SITE SELECTION

2.1 SUMMARY

This section of the report summarizes the preliminary site identification and selection phase. Six potential sites were identified and five were evaluated. The evaluation included the physical features, social and environmental factors, costs of development and other economic factors using a ranking process developed by the consultants.

Of the five sites originally identified, the most favourable selection rated on cost was Site I - Damsite, very closely followed by Site II - Oasis Road and Site III - Murphy Creek. On the basis of an evaluation of: 1) social and environmental factors and 2) social and environmental and physical/economic factors, Sites II and III ranked as first and second choices. Site VI, which was added at a later stage, was not evaluated but was judged not to have sufficient advantage to affect the front ranking.

In the Consultants' view, the most favourable location was Site II, followed by Site I. However, following a public participation process and discussions with personnel from B.C. Hydro, Site I - Damsite was chosen for preliminary design studies.

2.2 FUNCTIONAL PROGRAM

Based upon the requirements set out in the terms of reference, as modified by the B.C. Hydro letter of 20 January 1982 reducing the accommodation requirements, a functional program for the camp facilities in terms of building areas, facilities to be included, parking and land requirements is presented on Table 2-1.

This program reflects the camp facility requirements as established by the B.C. and Yukon Joint Trades Council Agreement; the B.C. Hydro office and facilities requirements based upon discussions with B.C. Hydro staff and standards of space and facility provided at the Seven Mile Project; together with our own assessments of land area and parking requirements based upon National Building Code requirements, fire fighting practices and industry standards for parking.

2.3 SITE LOCATION

(a) Approach

Site selection was based on a two-stage process:

1. Determination of key criteria used to identify potential camp sites.

2. Identification of potential camp site locations meeting the key criteria.

(b) Key Criteria

The key criteria selected as essential to identify potential camp sites were:

1. available site area,
2. distance from the damsite,
3. proximity and impact on existing development, and
4. terrain affecting costs of servicing and ease of access.

The basis for using these criteria and the standards selected were:

(i) Site Area

Using the building sizes, separation requirements and parking demands derived from the functional program, site areas were established with appropriate allowances for access, boundary setbacks, circulation and screening. Depending upon the configuration, a minimum site area of about 3.5 ha was determined and a preferred site area of about 5.0 ha was recommended.

This preferred site area of 5.0 ha would include an allowance for livability and aesthetic layout over the minimum functional requirement.

(ii) Distance from the Damsite

The effects of travel time in a project of this magnitude are significant since travel to and from the damsite normally takes place within regular shift time.

Based on estimates of travel time and costs over the period of construction, 4 km was selected as the maximum acceptable one-way travel distance.

(iii) Proximity to Existing Development

Possible sites in close proximity to existing development were only considered suitable if the potential was available to mitigate development in terms of adequate separation and buffering, both for visual and noise impacts. No locations requiring access through existing development or causing a significant traffic impact on existing development were considered.

(iv) Terrain

The potential sites were required to meet certain standards as acceptable terrain for development. Cost considerations and ease of physical access dictated that the ruling grade could not be too steep and as far as possible rock excavation should be avoided.

Some degree of slope on the site was regarded as advantageous, providing both the opportunity for view potential and a reduction in average excavation depths.

The terrain criteria chosen was that the average grade should not exceed 15 percent, and there was to be no significant rock outcropping.

(c) Potential Sites Selection

To identify possible sites meeting these key criteria, a map search using the topographical mapping supplied by B.C. Hydro (5 m and 2 m contour plans at 1:10000, 1:5000 and 1:2500) was carried out. This map search was supplemented by inspection of the 1:3600 aerial photography. Possible sites were identified for inspection on site and an assessment of the general situation of each was made with respect to terrain, aspect, present use, access and visual relationship to other physical features. A review of the Resource Atlas[1] did not suggest significant environmental problems with any of the sites which could not be accommodated by appropriate mitigation measures.

Five possible camp sites were initially identified for consideration (Table 2-2). To establish a relative order of preference, a rating procedure, summarized in Section 2.5 was developed.

Following review of additional aerial photography, a sixth possible site was identified. After discussion with B.C. Hydro personnel, this site was included in the assessment but not the evaluation.

2.4 INDIVIDUAL SITE EVALUATION

This section summarizes the general site considerations and presents specific discussions of each potential site relative to the selection criteria, together with a review of any special conditions which apply.

The locations of the potential sites are shown on Fig. 20.1-A.

(a) General Considerations

Travel time criteria strictly limit the number of possible sites for consideration. Suitable sites are confined to the lower terraces of the west bank of the Columbia River which vary in width from about 150 m to 450 m.

Much of the terrace area is already occupied by the Trail/Castlegar Highway (No. 22); the CPR single rail line and the eight single pole 60 kV powerlines of West Kootenay Power & Light Co. Ltd. These facility corridors, particularly the transmission lines, eliminate a large proportion of the otherwise potentially available area. In addition there is existing development in the area, both residential at Oasis and Rivervale and the Birchbank golf course. The amount of potential area available and suitable for development as a camp site is very limited if excessive costs, due to extensive rock outcropping or steep grades are to be avoided.

Some potential areas would be constrained by the combination of site area and shape and in these cases some degree of separation of

facilities (e.g. location of warehouse and laboratory) would be necessary.

In terms of potential environmental impact, the issues of significance appear to be confined to social and visual impacts for all of the sites identified. Only one site is close to existing development and aside from noise and visual impacts, the most significant factor is probably the impact of additional construction traffic on Highway 22.

A review of the environmental work already completed, summarized in the Resource Atlas[1] indicates that there would be no serious impacts on forestry, vegetation, agriculture, wildlife habitat or fish habitat from any of the camp sites. Camp site I would impact on an identified heritage site[2]; however this impact could be minimized by the implementation of mitigation measures.

Sites I, II and III were identified as having long-term recreational potential.

There would be two main impacts from construction traffic generated by the camp and office complex: The traffic between camp and construction sites, and the local traffic generated by camp residents and non-resident day workers.

The impact of traffic on local communities would vary dependant on the site location. For sites upstream of the damsite construction traffic would create least impact on the local communities. Sites downstream of the damsite would generate less local traffic impacting on the local communities of Oasis and Rivervale than for upstream sites, but construction traffic would be greater than for upstream camp locations.

Location of a camp site on either side of Highway 22 was not considered a significant factor since all sites except Site I involve highway travel and traffic would have to make left turns in one direction or the other.

(b) Potential Sites

Site I - Adjacent to Damsite and Rivervale

The area between the project site and Rivervale and bordered by the railway and the Columbia River would be used as a general construction work area regardless of the location of the camp. The potential area for Site I is located within this general work area.

The site is presently vacant with open spaces, sparse trees and undergrowth. The area would allow development with good separation of the buildings and access direct from Highway 22 or the construction access road. The terrain would allow orientation of buildings towards the river with good view potential for camp residents. The costs of servicing and development would be moderate.

The location immediately adjacent to the works represents the lowest travel time with the possibility of walking access to a major part of the construction site. The centre of construction activity would be approximately 500 m from the nearest bunkhouse.

Site II - Junction with Oasis Road, North of Damsite

The site is presently vacant and is covered with light mixed deciduous trees and undergrowth with some grassy areas. The site would be divided by the northern road connection to the community of Oasis and would be restricted by the presence of the West Kootenay Power & Light transmission lines to the east and rock outcrop to the south.

The area to the east of the Oasis Road is restricted because of its shape. It would be possible to locate the main facilities including bunkhouses, kitchen, dining and office buildings, within the area, but the service garage, laboratory and warehouse buildings would need to be located elsewhere. These facilities could be accommodated within the area west of Oasis Road or at the damsite.

Site II is located about 1.5 km from the damsite. The site has slight grades and would afford some view potential for residents while the separation from the project site and other development would be a benefit. Costs of service development would be moderate and there would be potential for post-construction development as a recreational campsite or for residential purposes.

Site III - Murphy Creek

This site is located below and to the east of Highway 22 and between the highway and the railway. The site is vacant with sparse tree cover and undergrowth. The area is bisected by the WKPL transmission lines and is also on two main terrace levels separated by an escarpment some 10 m high. Part of the lower level is below the normal operating level of the reservoir. During railway relocation works, some of this lower terrace could be filled and be made available for camp and possible long-term use.

Though the total area is adequate, the site would be constrained by the location of the power lines and the escarpment but a suitable layout of the principle facilities would be feasible. Apart from the escarpment, the grades and ground conditions are suitable for camp development. Travel distance would be approximately 1.8 km.

In terms of visual impact, the site could be partially screened from the highway.

The site would have long-term potential for recreational development, perhaps even for marina purposes as well as recreational camping.

Site IV - Opposite Golf Course

This site is located west of Highway 22 and north of the golf course entrance. The site is presently vacant and has moderate, light tree cover. A road opposite the golf course entrance would allow access to a long narrow site between the top of the highway cut and the WKPL transmission lines. The site is restricted but would provide sufficient area for a camp layout, with two-storey bunkhouses. Travel distance would be approximately 3.1 km.

The grades on the site are moderate with granular overburden materials. Costs of site services would be reasonable, however, a suitable water source, either from groundwater sources or creek flows is estimated to be more costly at this site compared to others.

Visual impact of this site from the highway would be minimal because of its high elevation. However, the camp would be visible from the golf course as, though the site is well treed, cover is not dense enough and space would not allow retention of a natural tree barrier.

Site V - West of Highway, South of Rivervale

This location has an extensive area of land with satisfactory grades adjacent to and above Highway 22. The travel distance would be about 2.2 km.

The site is presently vacant and is bisected by the WKPL transmission lines and aerial photographs show extensive rock outcrop. Due to the rock outcrop, site development costs would be high.

A reasonable camp design could be developed on this site, however, the visual impact from the highway and other developments in the area would be significant. The site would afford good view potential across the Columbia Valley though the aspect is northeasterly.

Site VI - East of Highway, South of Rivervale

This location was added after obtaining additional aerial photography and following discussion with B.C. Hydro personnel. The area is east of the highway and north of the deep gully of Stoney Creek. The area is bisected by the pumping mains for the Cominco water system. The most suitable part of the site is presently used for storage of construction materials and as a limited source of gravel materials. The travel distance to the damsite would be about 2.5 km.

An assessment of the aerial photograph indicates varied terrain with significant rock outcropping to the north and gravel to the south. The northern part appears to have a number of small rocky hilltops with varied slopes. The area would be adequate to accommodate the necessary facilities but would require care in siting buildings because of the grade and irregular contours.

(c) Preliminary Servicing Costs

In order to provide a basis of comparison to assist the evaluation process, preliminary cost estimates for trunk and site services for each site were prepared. These estimates are based on assumptions as to the source of water supply and method of providing treated

water and sewage services for each site. The estimates are valid only for comparative purposes and should not be read as definitive estimates of the probable final cost of servicing.

The comparative cost estimates for water supply and sewage systems were as follows:

Site I	Water supply by well and pump to storage tank with allowance for river intake if required; packaged sewage treatment plant and outfall	$ 830,000*
	* [After Site I was chosen as the location of the proposed camp development, the water supply and sewage system requirements were studied more fully and an estimated cost of $725,000 was determined (Section 3.3).]	
Site II	Water supply by well and pump to storage tank with allowance for river intake if required; packaged sewage treatment plant and outfall	$ 890,000
Site III	Water supply by well and pump to storage tank with allowance for river intake if required; packaged sewage treatment plant and outfall	$ 830,000
Site IV	Water supply by creek intake, storage tank with allowance for river intake and treatment if required; packaged sewage treatment plant and outfall	$1,000,000
Site V	Water supply from Tadanac treated source, pump and main to storage tank; packaged sewage treatment plant and outfall; allowance for extensive rock excavation on site	$1,300,000
Site VI	Water supply from Tadanac treated source, pump and main to storage tank; packaged sewage treatment plant and outfall	$ 920,000

2.5 SITE EVALUATION PROCESS

This section describes the methodology used in the camp site evaluation process and a summary of results.

(a) Methodology

The evaluation process used the established technique of numerically rating individual sites against weighted evaluation criteria. The relative advantages of each of the subject sites was determined by awarding a point rating to each individual site against the chosen evaluation criteria.

As part of the evaluation process, independent rankings based on social and environmental factors, cost, and a combination of both, were prepared.

The recommendation of site location was made partly on the basis of this evaluation, as the process provided a framework of reference to better appreciate the relative influence of conflicting requirements so that one factor would not be allowed to dominate. The recommendation of site location was also made on the basis of public consultation.

(b) Summary of Results

Sites I, II and III were very close in the overall ranking of sites and the difference in estimated cost between them was less than 8 percent. Site I benefited from proximity to the construction site and lowest assessment of worker travel time. Sites II and III would have the lowest development costs based on terrain and opportunities for servicing. Sites II and III also have the best social and environmental ranking based on their location at a

reasonable distance from local communities and the construction site and their potential for future use.

Based on the preliminary studies, it was concluded that:

1. The most favourable site is Site II.

2. Sites I and III are close in overall ranking to Site II.

3. Any of the three sites would be suitable for development.

2.6 PUBLIC CONSULTATION AND SITE SELECTION

The Project Impact Committee (PIC) was kept apprised of study progress and a Public Meeting was organized to obtain public opinion on the selection of a campsite. Prior to the meeting, a summary report was delivered to Oasis and Rivervale residents and notices advising of the meeting were published in the local media. The meeting chaired by the PIC, was held on 5 May 1982 and was attended by an estimated 120 to 140 people, with extensive local media coverage. The meeting took the form of a public forum and, following presentations and discussions, the majority of the people present expressed support for Site I as the location of the potential camp site. This position was confirmed by press reports.

Following the meeting a questionnaire, asking respondents to indicate their site location preferences, was handed out to those in attendance.

The results of the questionnaire, which generated a response of about 23 percent, confirmed a significant preference for Site I on the part of the respondents. On the basis of this preference, together with media

and PIC comments, B.C. Hydro, after review with the Consultants, concluded a consensus existed to adopt Site I.

An announcement was made of this conclusion to the PIC and the media and B.C. Hydro accordingly instructed the Consultants to proceed with preliminary design for Site I - Damsite.

SECTION 3.0 - PRELIMINARY DESIGN

3.1 SUMMARY

Site I - Damsite, was chosen for the camp and office development following a public participation process and discussions with personnel from B.C. Hydro. The preliminary design is based on a camp and office development located on this site.

The preliminary design plan was based on reduced facilities from the original terms of reference. The plan was developed to provide a reasonable balance between amenities for the residents, operating effectiveness, respect for the local communities, potential for future use and costs. The plan is supported by detailed proposals for servicing and estimates of cost.

3.2 PROPOSED DEVELOPMENT

The proposed camp development at Site I - Damsite, would be located downstream of the dam axis and just upstream of Hanna Creek (Fig. 20.1-1). The site is separated from the community of Rivervale by Hanna Creek and has an area of approximately 4.9 ha.

(a) Design Constraints

Because of its proximity to the project site, some areas adjacent to Site I would be required for construction purposes.

At the southern end of the site, Hanna Creek provides a natural barrier between the campsite and the community of Rivervale. To reduce impact on this community, a separation would be required

between the camp development and the creek. These considerations, together with the physical constraints of the railway embankment and the high river bank, limit the actual area available for camp development.

(b) Facilities Requirements

In order to save space, the following facilities which were included in the original terms of reference were deleted from the study.

- Rail siding access to the camp area,
- warehouse,
- service garage, and
- materials testing laboratory.

These facilities would be located elsewhere on the project site.

In order to further conserve space, the camp design was based on the use of 80-man, double-storey bunkhouses rather than 42-man, single-story design used to determine camp space requirements. The preliminary design proposal is based upon the revised functional program shown in Table 3-1.

(c) Camp Layout

To accommodate the preliminary design criteria for the camp in respect to livability, community impact and potential future use, the site would be filled and recontoured. Initially overburden would be removed, and rock spoil from the powerhouse excavation would be placed to an average depth of about 2 m. Granular fill would be placed under the service corridors and finally the overburden would be replaced where required.

The site would be raised between 2 and 4 m to provide a grade sloping towards the top of the existing riverbank. The site would be contoured to form a shallow bowl-shaped area, graded to approximately 8 percent facing the river.

Fig. 20.1-1 shows the general site layout, locations of buildings and parking areas, proposed grades, elevations and approximate contouring based upon topographic information enlarged from 1:1250 aerial mapping. The bunkhouses would be separated from the construction site but the dining and office facilities would be closely integrated with both the camp and the works. These facilities, which would be used by both camp residents and dayworkers, would be located to form a functional barrier between construction activities and the residential part of the camp. The layout would also isolate the shift change mustering activities from neighbouring communities.

The bunkhouses would be arranged to follow the new contouring in a terraced format facing the river. The bunkhouse group would be flanked front and rear by residents' parking area to provide separation from the railway and the office area situated on a lower bench overlooking the river.

Vehicular access would be provided to bunkhouses for emergency and service vehicles only. Other camp roads are laid out to avoid impact on the residential area. Normal access would be by a system of covered pedestrian walkways interlinking the bunkhouses, recreation building and kitchen/dining complex.

A 30 m buffer zone of undisturbed treed area would be retained along Hanna Creek to provide a visual and sound separation between the camp and the Rivervale community. As far as possible, the riverbank would be maintained undisturbed. Additional landscaping is proposed in Section 3.5, Architectural & Landscaping.

(d) Construction Phasing

The terms of reference call for a camp which can be expanded from a capacity for 450 men over the first 2 years of construction to 600 for the latter part of the construction.

The design drawings presented in this report illustrate the final development of the camp. The first phase of construction would comprise erection of bunkhouses Nos. 1 to 6 and phase one of the kitchen/dining complex shown on Fig. 20.1-1, together with the recreation hall, B.C. Hydro and CHC offices as shown. The road and service systems would be fully developed except for the lower level of resident parking which would be only 25 percent developed.

Phase 2 development would comprise the addition of bunkhouses 7 and 8, one of which could be reduced to a standard 42-man single storey bunkhouse if the projection for accommodation requirements proves accurate, together with an additional dining unit and the balance of the resident parking.

3.3 SERVICING

The following services have been included in the camp development plan:

- Roads
- Parking areas for residents and visitors
- Water supply and distribution
- Sanitary sewers and distribution
- Storm sewers and drainage facilities
- Electrical power supply
- Lighting
- Natural gas supply

- Telephone service
- Cable TV service

The proposed type and layout of each is presented as follows:

(a) Roads

Access to the camp would be from Highway 22 and be combined with the main access to the construction site (Fig. 20.1-1).

The camp access road would be 8 m wide with adequate drainage facilities to ensure structural stability and the removal of stormwater runoff. Building service roads within the camp would be 7 m wide with adequate turning and manoeuvering areas, drainage, and snow storage areas for winter operation.

The access road and service roads would be paved in order to minimize maintenance and reduce dust (Section 3.6).

(b) Parking Areas (see Drawing No. 20.1-1)

Parking facilities would be required at the campsite for camp residents, servicing staff and B.C. Hydro office staff. Visitor parking would also be required for the B.C. Hydro office building. These site parking areas would be paved.

Three hundred and twenty-five (325) parking spaces would be required at the camp and 30 spaces at the B.C. Hydro office site. Also a large muster area for buses would be required in the vicinity of the kitchen and dining facilities.

Parking spaces would also be required for day workers. This parking requirement would be met by providing an area remote from the camp where a second muster station can be established. A

possible site for the day worker parking and muster area would be on the west site of Highway 22, close to the site.

(c) Water Supply

The water supply scheme for the campsite would provide a reliable and adequate source of potable water for operation of the camp and for fire protection. A storage tank would be constructed to hold sufficient water to provide standby capacity in case of breakdown in supply equipment, in addition to water for fire fighting. Use of a storage tank would provide greater reliability than mechanical standby equipment.

Water supply flows for design purposes have been based on a camp population of 600, with an allowance of an additional equivalent 100 population for day workers. Average day flows of 360 ℓ/capita have been adopted with peak day flows of 680 ℓ/capita and peak hour flows of 1130 ℓ/capita which result in the following:

Average Day Flow	252 000 ℓ/day
Peak Day Flow	476 000 ℓ/day
Peak Hour Flow (expressed as flow per day)	791 000 ℓ/day

When considering fire flow requirements, it is normal to work within the guidelines set out in the publication, "Water Supply for Public Fire Protection 1981, A guide to Recommended Practice", by the Insurance Bureau of Canada. However, this publication does not contain specific recommendations for work camps, but consultation with local Insurance Bureau of Canada staff has indicated that a fire flow of 9 100 ℓ/min would be reasonable. For such a flow, the fire storage requirements should be based upon a flow duration of 2 hours.

Overall camp storage requirements have been calculated to be 1 180 000 ℓ on the basis of 0.2 peak day flow plus fire flow duration.

The Columbia River would be used as the source of water supply for the camp. This source would be independent of streams on which water licenses exist and private water supply systems.

The proposed layout for the water supply system is shown on Fig. 20.1-2 and the estimated costs are as follows:

Columbia intake and pumping station	$ 60,000.
Pipe to site of treatment plant and storage tank: 600 m of 150 mmØ @ $85.00/m	50,000.
Disinfection and treatment plant	100,000.
Storage tank (1 180 000 ℓ capacity)	250,000.
Supply line to distribution system 450 m of 300 mmØ @ $145.00/m	65,000.
	$525,000.

(d) Alternative Water Supply

An alternative to the proposed water supply system was identified during a study of a number of water supply options. The alternative is described as a possible mitigation measure (Section 3.6).

The alternative would be a connection to the existing Cominco water supply system which extracts water from the Columbia River at the Stoney Creek pumphouse and supplies the Cominco smelter and the communities of Tadanac and Warfield. Fig. 20.1-3 shows existing waterworks systems in the area. Fig. 20.1-4 shows the proposed alternative water supply system for the camp.

The Downstream Water Use study[3] indicated that there is spare capacity in the water treatment plant at the Tadanac site.

From the Tadanac storage tank located adjacent to Highway 22 at Stoney Creek Road, a 150 mm diameter pipeline could be layed along the highway right-of-way to connect to a new storage tank above the camp. This pipeline could pass peak day flows for the camp with peak hour balancing and fire flow requirements provided by the storage tank.

To ensure that the Tadanac treatment plant capacity would be adequate under all flow conditions, the mixed media in the existing filters should be upgraded.

The estimated capital cost for the alternative water supply option including the connection to the Tadanac storage tank and laying a pipeline in the highway right-of-way directly to a new storage tank above the camp would be as follows:

Upgrading of Tadanac mixed media filters	$ 40,000.
150 mmØ connection from Tadanac to new storage tank 2650 m @ $85.00/m	225,000.
Storage tank (1,180,000 ℓ capacity)	250,000.
Supply line to camp distribution system 450 m of 300 mmØ @ $145.00/m	65,000.
	$580,000.

(e) Sanitary Sewers

The camp and all facilities would require a comprehensive sanitary sewerage system, which should incorporate grease traps for kitchen waste, and a means of sewage disposal.

Sewage flows for sewer design purposes have been based on a population of 700, to allow for the 600 camp residents and day workers. A flow of 270 ℓ/capita/day has been adopted with a peaking factor of 4.5, which results in the following:

Average day sewage flow	189 000 ℓ/day
Peak sewage flow	850 000 ℓ/day

(f) Sewage Disposal

The proposed sewage disposal system for the site is a package sewage treatment plant and outfall to the Columbia River. A plan of the proposed system is shown on Fig. 20.1-5.

This treatment plant would be designed for domestic waste with a flow of 270 ℓ/capita/day and 5-day BOD and suspended solid loadings of 110 and 130 g/capita/day respectively. The plant would be capable of accepting shock loadings due to intermittent camp use and have the flexibility to deal with low commissioning loads. Effluent chlorination would be required with 1 hour contact at average flow rates and a free chlorine residual between 0.1 and 1.0 mg/ℓ.

Effluent standards would be established by the Provincial Ministry of Environment Waste Management Branch upon permit application and after due consideration of dilution and downstream use. Considering only dilution, the effluent standard would be Level AA requiring maximum 5-day BOD and suspended solids of 100 mg/ℓ.

The estimated capital cost of an individual sewage treatment plant and outfall to the Columbia River is approximately $200,000.

(g) Alternative Sewage Disposal

An alternative sewage disposal system was identified as being feasible for the camp and a possible mitigation measure (Section 3.6). This would be a connection to the existing Rivervale system which connects to the Trail sewage treatment plant.

A sewage collection system exists for the communities of Oasis and Rivervale which discharges to a pumping station in North Rivervale adjacent to the Columbia River (Fig. 20.1-6). Sewage is pumped from this station via a forcemain along the highway right-of-way to the Cominco gravity sewer system which eventually outfalls to the Trail system and the Trail sewage treatment plant. This Trail treatment plant is owned by the Regional District of Kootenay Boundary and operated under contract by City of Trail staff.

The close proximity of the proposed camp to the sewers and pumping station in the northern extremity of Rivervale make a direct sewer connection from the camp to the existing sanitary sewerage system feasible.

A connection to the existing Rivervale system would require a gravity or syphon crossing of Hanna Creek with a connection into the existing sewer on 3rd Avenue.

The Rivervale pumping station is presently under-utilized, operating approximately 30 min/day. Consequently, the system has spare capacity and would be capable of accommodating the additonal flows from the proposed camp.

An operational advantage to tying in the camp system to the existing Rivervale pumping station and forcemain would be that the additional flows would reduce the time in the forcemain with a

reduction in the likelihood of the sewage becoming septic. The addition of the camp sewage should not greatly change the volume in the Cominco receiving trunk sanitary sewer and the discharge rate would be unchanged.

However, it is reported that there may be capacity problems in the Trail sewerage system due to infiltration. This problem relates to the pipe sizing of the collector and trunk sewers. It is understood that the sewage treatment plant is currently under-utilized. Should this alternative sewage disposal system be considered as a mitigative proposal, the feasibility of using the Trail sewerage system should be confirmed.

(h) Storm Sewers and Drainage

The access road, service roads, parking areas, walkways and camp facilities would require a storm drainage system. This drainage system would remove surface run-off and outfall to the Columbia River (Fig. 20.1-5) and would include separator and sediment traps.

(i) Electrical Power Supply

The estimated power demand for the full camp facilities is approximately 1200 kVA based upon the requirement for individual mixed heating to each bedroom with air conditioning. It is proposed to distribute this load through three 500 kVA unit substations.

This service would be brought in from the West Kootenay Power & Light supply at the southwest corner of the site close to Hanna Creek. Power would be available at 12 kV from the 60 kV lines. The 12 kV supply would involve costs of $50,000 for a substation. The main high voltage disconnect and ground would be located at this point. The incoming high voltage main at 12 kV would be carried overhead on timber poles alongside the boundary of the

southern parking areas to the midpoint of the bunkhouse complex and then to the three 500 kVA pad mounted kiosks for low voltage distribution to the individual buildings. The secondary distribution would be on a 120/208, three-phase, four-wire system with the building loads estimated as follows:

Bunkhouses (each)	400 A
Kitchen/dining	800 A
Recreation Hall	200 A
Offices (each)	200 A

Fig. 20.1-7 shows the schematic design layout for the site and the electrical load system.

(j) Lighting

High pressure sodium (HPS) lights would be installed for general site lighting supplemented by tungsten security lights at each building entrance. The design is based upon 400 W HPS luminaires mounted on gooseneck arms on 10.5 m steel standards. These units, though higher in first cost, are extremely energy efficient and provide superior lighting characteristics to the usual 250 W mercury vapour luminaire (Fig. 20.1-7).

(k) Natural Gas Supply

Natural gas is available in the area from the Inland Natural Gas system. A high pressure main is located to the west of Highway 22 at the higher bench levels above the Oasis development. This main varies between 400 and 800 m from the highway in the damsite area.

Inland Natural Gas would install a branch from this main to the campsite. The route would most probably follow Hanna Creek and a 50 mm diameter service line would be provided.

The site distribution system is based upon taking a 50 mm diameter main from the Inland branch shut-off valve at the site boundary, with 30 mm diameter branches to all buildings on the site (Fig. 20.1-8).

Service distribution would be underground by standard black pipe with protective wrapping at 60 psi with individual pressure regulators reducing this to 5 psi for each building for internal distribution to all points of use.

(l) Telephone Service

Telephone service would be available from B.C. Telephone. At present the capacity from the Trail or Genelle district frames is insufficient to supply the minimum of 50 pairs likely to be required. The other lines past the site are reserved for toll traffic and are not available for local service. It is probable therefore that a new fifty or hundred pair cable would need to be installed from either Trail or Genelle. Based on the temporary nature of the line, it is estimated that an installation cost of approximately $70,000 would be charged. Alternatively, at this cost, it may be economic for B.C. Hydro to consider installation of a microwave radio link which could be provided from either Trail or Genelle.

Internal site linework would be charged at cost for both the 50 pair link or other services. The estimated cost for this work, including pole installations would be about $12,000.

(m) Cable TV Service

The B.C. & Yukon Building & Construction Trades Council Agreement calls for provision of a TV outlet in each room serviced by a central antenna, or where TV reception is inadequate, provision of

movies or video tapes. For the camp installation of a private satellite dish antenna is proposed. This facility would ensure good reception and offer a selection of channels and programming, not available through normal antenna installations or local cable TV systems.

3.4 ARCHITECTURE AND LANDSCAPING

(a) Site Planning

The residential and operational parts of the camp have been separated as far as possible within the constraints of space, and the need for residential accommodation to have good access to the dining facilities (Fig. 20.1-1).

The residential area would be contoured to form a bowl shape facing the river. This contouring provides a modified landform to reduce construction noise by providing a physical, as well as a visual barrier.

The bunkhouse buildings have been sited to follow the contours in terraces, taking advantage of the view potential towards the river. The layout avoids the total rigidity of most campsites, providing a greater degree of visual identity to the individual buildings without incurring cost premiums in the process. The bunkhouses are separated from other camp activities and traffic by areas of resident parking.

Kitchen, dining and recreational facilities have been located adjacent to the residential facilities to serve as both a visual barrier and a functional link with the construction area, plus a mustering area.

The lower areas adjacent to the river and the creek mouth of Hanna Creek would be filled. The B.C. Hydro offices would be located in this area to allow easy access to the work facilities.

The buildings have been kept tightly grouped, however, the separations are greater than the minimums permissible under the National Building Code. This would improve livability.

(b) Buildings

All buildings on the camp site would be modular structures.

The basic building layouts offer little scope for architectural originality since the options are limited in most cases by the configuration of the buildings and the space available on this site.

However, the landscaping proposals, together with the siting of buildings, and choice of colour scheme, would provide a pleasing visual impact.

Industrial modular buildings commonly feature white or very pale coloured walls, usually relieved by a brightly contrasting fascia at the roof line. It is recommended that a combination of two darker complimentary neutral tones be chosen to blend with the surrounding landscape. This approach would have the effect of making the buildings seem smaller, whereas very light colours accentuate the mass of the building. To give identity to individual buildings, bold use of contrasting different colours could be employed for specific features. For example, the stair enclosures of the two-storey bunkhouses could be painted a different bold colour for each building. There is also the opportunity to further identify individual buildings by the use of large graphics.

(c) Landscaping

The selective use of limited planting would improve the living environment for both residents, visitors and the public able to view the camp. Given the local climate, with the combination of hot, dry summer periods and extensive winter snow cover, planting must be compatible with these conditions. Over the life of the camp, tree growth would be barely sufficient to get established. Planting, therefore, should be confined to the use of shrubs of local hardy varieties and areas of seeding such that extensive irrigation is not required.

The landscaping proposals are illustrated on Fig. 20.1-9. Along the banks of Hanna Creek and the Columbia River, the existing tree cover would be retained as much as possible. Over the balance of the site a tree survey should be carried out. This survey would identify trees which can be preserved without major modification to the grading proposals or building layouts.

The camp design includes the proposed mitigation measure to surface access roads and parking areas with blacktop. The boundaries of these areas should be positively defined and paved pedestrian access provided to all key facilities. Between the bunkhouses and parking lots, areas of grass are proposed for privacy and relaxation. Corners of grassed areas at junctions of paths should be reinforced with shrubs and the paving set out to cater to the natural route paths for pedestrian traffic.

Parking lots set on fill areas or cut into the hillside would be provided with stair access and sections of simple post and rail fencing to encourage use of the stairs and paths provided. When other definition of parking areas is required to discourage parking on grassed or undeveloped areas, this would be achieved very economically by placing lines of native boulders or logs at the

edge of areas, provided openings are left to permit snow clearing and emergency vehicle access to undeveloped areas.

All formal grassed areas would be sited so that irrigation can be arranged from building water services.

3.5 COSTS OF DEVELOPMENT

Preliminary camp development costs including off-site servicing, site preparation, on-site servicing, building or landscaping costs, are shown on Table 3-2 (September 1982).

3.6 MITIGATION/COMPENSATION AND LONG TERM USE

(a) Mitigation Measures

The proposed features of the design which would provide mitigation of either the camp impact on the local residents or the effect of the works on both the camp and area population are:

Location: The site's location between the works and the community of Rivervale would provide an effective buffer zone and screen for noise and visual impacts on the Rivervale residents. In addition, the location between river and railway screens the camp from the highway.

Grading: The proposed filling and contouring creates additional elevation between the major works and the residential camp area and Rivervale.

Paving Roads: The access road and service roads would be paved in order to minimize maintenance and reduce dust.

Orientation: The terraced bunkhouse format and orientation towards the river provides greater privacy to both camp and Rivervale residents.

Access: Location of the camp access north of the site and off the dam access road avoids traffic impact from both Rivervale and Oasis areas.

Internal Layout: This ensures all heavy traffic and most of the light traffic is separated from camp residents by central dining facilities and resident parking, while the residential area of the camp screens Rivervale from heavy traffic activity.

Landscaping: Retention of existing tree cover along Hanna Creek and the river would both reduce visual impacts and help to screen noise and dust from local residents.

Servicing: Installation of key services for the camp could afford an opportunity for upgrading other community services during and after the construction including improved water supply, sewage disposal and availability of natural gas.

Possible mitigation/compensation measures would include upgrading of local water supply and sewage disposal systems for Rivervale and Oasis by allocating to them costs that would otherwise be spent on developing separate systems (see Section 3.3).

(b) Long-term Uses

The planning concept employed is designed to offer a number of alternatives for potential long-term development.

The camp area would be graded and landscaped and would have a spine system of water, sewer, gas and electric services which could be utilized in a number of ways for future redevelopment. Specific possibilities are:

(i) Residential Subdivision

The services provided for the camp could be used as a framework for subdivision purposes, either as single-family lots or for multi-family development.

(ii) Mobile Home Park

The services provided for the camp could be developed to provide an extensive area of mobile home pads.

(iii) Recreational Campsite

The general contouring would be easily adaptable to provide an extensive and attractive recreational campsite, though some tree planting would be desirable for this purpose. Trailer parking and development in conjunction with water-oriented activities would be attractive.

(iv) Tourist Development

The servicing and site forms would be suited to development of tourist-oriented attractions, for example, a major theme park including water-oriented activities. For this type of

development, some of the existing buildings could be retained, such as modified kitchen/dining units.

(v) Community Recreation

The area would be suitable for community park development, though this would not exploit the full value of the installed servicing. The park could be developed with a specific feature as a focus: a waterfront open-air theatre in the office area.

3.7 OTHER AMENITIES

Recreational facilities are required by the B.C. & Yukon Building & Construction Trades Council Agreement for camps. There is no requirement for outdoor recreational facilities in the Agreement, however, some outside areas are recommended for recreation purposes. The grassed area in the southeast corner of the site would be suitable for ball games. Other outdoor recreation possibilities would include the installation of basketball hoops and a sand green for putting.

In addition to the items specified by the Agreement, provision of a video cassette recorder and player in the recreation hall is recommended. The installation of electronic games, which are available on lease/maintenance terms, could be used as revenue producers for a camp improvement fund.

3.8 REGULATORY ISSUES

The terms of reference require identification of the applicable federal, provincial and local by-law restraints. A review determined that camp development would be subject to regulation in the following areas:

(a) Development Approval

In British Columbia, the Approving Officer for subdivision and development in unincorporated areas is the Regional Highways Engineer of the Provincial Ministry of Highways and his approval would be required for any access to a Provincial Highway.

(b) Railway Crossings

Utility or road crossings of any federally regulated transportation facility require the granting of an easement and the approval of the Canadian Transport Commission. The camp development would require such approval for crossing the Canadian Pacific Railway for road and pedestrian access, water supply, natural gas supply and possibly electric power and telephone services.

(c) Water Licence

In order to extract water from the Columbia River it would be necessary to obtain a Water Licence from the B.C. Ministry of Environment, Water Management Branch.

(d) Approval to New Watermains

Prior to the construction of watermains and the site distribution systems, it would be necessary to obtain a certificate from the B.C. Ministry of Environment, Public Health Engineer.

(e) Sewage Treatment Plant and Sewerage System Approval

A permit stipulating effluent standards would be required for any discharge into the Columbia River. This application would be obtained from the Ministry of Environment, Waste Management Branch. The application which would include details of the sewage

collection system would be circulated by the Branch to all interested "Agencies" for review and comment prior to the final establishment of effluent standards.

(f) Columbia River and Hanna Creek

Any work in or adjacent to the Columbia River or Hanna Creek will be the subject of review and approval by B.C. Ministry of Environment, Fish and Wildlife Branch and Water Management Branch. Enquiries made with the Government of Canada Fisheries and Oceans have revealed that the site is outside their area of concern.

(g) Community Water Supply and Sewage Disposal

If a decision is made to pursue the options available for connections to the existing Cominco waterworks system and Rivervale sanitary sewerage system, it would be necessary to reach agreement and obtain approval from Cominco and the Regional District of Kootenay Boundary.

(h) Fire Protection

The camp has been designed to the requirements of the National Building Code for fire protection and the recommendations of Underwriter Laboratories where applicable. The authority for enforcement would be the Provincial Fire Marshall, unless delegated to a local service.

(i) National Building Code

All work is subject to the National Building Code of Canada.

(j) Dish Antenna

The jurisdiction for installation of dish antenna is in contention at present between the provincial and federal governments. As a private installation for internal dissemination without charge, the installation would not be subject to federal jurisdiction. However, the federal Ministry of Transport and Communication has sought to regulate similar common antenna situations and their approval may be a statutory requirement.

(k) Workers Compensation Board

While there is no formal design review process, the camp facilities are subject to the jurisdiction of the Workers Compensation Board on matters of safety. Before finalizing design details, an information meeting with the Industrial Health and Safety Division would be prudent.

ACKNOWLEDGEMENTS

Bowman Engineering Associates Limited acknowledges its debt to its subconsultants in carrying out this study. The following firms provided valuable assistance in the specific areas noted.

Hogan Beesley Engineering Ltd.

Trunk servicing and site services for water supply, sewage disposal and treatment, stormwater drainage, road profiles and drafting.

Waisman, Dewar, Grout

Advice in site selection, evaluation of environmental and planning criteria, site planning, building treatments and landscaping details.

Westec Electrical Services Limited

Conceptual power and lighting distribution design, preparation of cost estimates for electrical work.

Kevton Holdings Limited

Advice on planning, erection and transport of modular camp buildings and detailed cost estimates for new construction, transport, re-erection and refurbishing.

In addition to B.C. Hydro personnel, we have also received co-operation and assistance from the following organizations:

Pacific Survey - aerial survey material,

Mecman Engineering & Testing Ltd., Cranbrook - Rivervale services,

Cominco, Trail - water supply,

Regional District of Kootenay Boundary - economic information and water and sewerage matters,

City of Trail - sewage treatment,

West Kootenay Power & Light - power supply,

B.C. Telephone Company, Nelson - telephone services,

Chief Public Health Inspector, City of Trail - Hanna Creek water quality,

Ministry of Environment, Waste Management Branch - effluent standards.

REFERENCES

1. Thurber Consultants Ltd. 1982. Murphy Creek Project: Environmental Impact Assessment Resource Atlas. Prepared for B.C. Hydro, Vancouver, B.C.

2. Baker, J. 1983. Murphy Creek Project: Heritage Resource Detailed Impact Assessment. Prepared for B.C. Hydro, Vancouver, B.C.

3. Kerr Wood Leidal Associates Ltd. 1982. Murphy Creek Project, Environmental Impact Evaluation, Downstream Water Use Study, prepared for B.C. Hydro, Vancouver, B.C.

TABLE 2-1

MURPHY CREEK CAMPSITE
PRELIMINARY DESIGN STUDY
FUNCTIONAL PROGRAM

Item	Facilities to be Included	No. of Buildings	Total Floor Area/Space (m^2)	Special Features	Type of Construction
Bunkhouses	B.C. & Y.J.T.A. Standard 42-man bunkhouses				
	Stage I - 450 men	11	5,335	-	Prefabricated modular
	Stage II - 600 men	15	7,275		
Kitchen/ Dining	B.C. & Y.J.T.A. messing requirements				
	Stage I - 650 men (partly from 7.M.P.)	2	1,565	Basic kitchen/dining 20 units from 7.M.P. + 7 add. units = 27	Prefabricated modular
	Stage II - 800 men	3	1,739	3 additional units	
Recreation	B.C. & Y.J.T.A. requirements: commissary, lounge, pool room, TV & card rooms, washroom	1	348	Coffee urns, ice machine and games tables	Prefabricated modular
B.C. Hydro Office	22 individual offices, general office washrooms & furnace rooms from 7.M.P.	1	662	-	Prefabricated modular

TABLE 2-1 (Cont'd)

Item	Facilities to be Included	No. of Buildings	Total Floor Area/Space (m^2)	Special Features	Type of Construction
Columbia Hydro Constructors' Office	3 individual offices, general office and washrooms	1	174	-	Prefabricated modular
Laboratory	3 lab areas, 3 offices curing room, washroom & furnace room (18.3 m x 9.1 m)	1	167	Block wall to curing room, laboratory benches, etc.	Pre-engineered steel
Garage	Work area, stockroom washroom and office	1	104	3.6 tonne hoist oil sump	Pre-engineered steel
Warehouse	Facility similar to 7.M.P. (36.5 m x 66.5 m)	1	2,419	Part heated only	Pre-engineered steel
TOTAL BUILDING AREA FOR PHASE II		24	12,888		
Parking I	Residents (325 cars)		10,034	-	Gravel paved
Parking II	Day Parking (160 cars)		5,017	-	Gravel paved
Parking III	Authority Facilities (incl. circulation)		6,345	-	Gravel paved
Parking IV	Dining/Kitchen (incl. circulation)		3,345	-	Gravel paved
TOTAL PARKING AREA			21,741		

Abbreviations: B.C. & Y.J.T.A. - British Columbia & Yukon Joint Trades Agreement
7.M.P. - Seven Mile Project

TABLE 2-2

POTENTIAL CAMPSITES

Site No.	Location	Possible Area (ha)	Travel Distance (km)	Comments
I	Adjacent to Rivervale and downstream of dam axis	4.9	0.5	Adjacent area required for construction
II	East and west of Oasis access road adjacent to power lines and north of dam axis	6.1	1.5	Additional area available west of Oasis Road
III	East of Trail/Castlegar Highway at Murphy Creek (upstream of dam)	5.33	1.8	Area bisected by power lines but more land available at lower level
IV	West of Trail/Castlegar Highway opposite golf course (upstream of dam)	4.9	3.1	Area available is barely adequate but could accommodate the required facilities
V	West of Trail/Castlegar Highway south of Rivervale	6.9	2.2	Location has greatest visual impact and overlooks Rivervale community
VI	East of Trail/Castlegar Highway south of Rivervale	5.0 (approx.)	2.4	Closest to City of Trail but overlooks Tadanac and Rivervale

The above sites are not presented in any order of preference.

TABLE 3-1 (Cont'd)
(Revised)

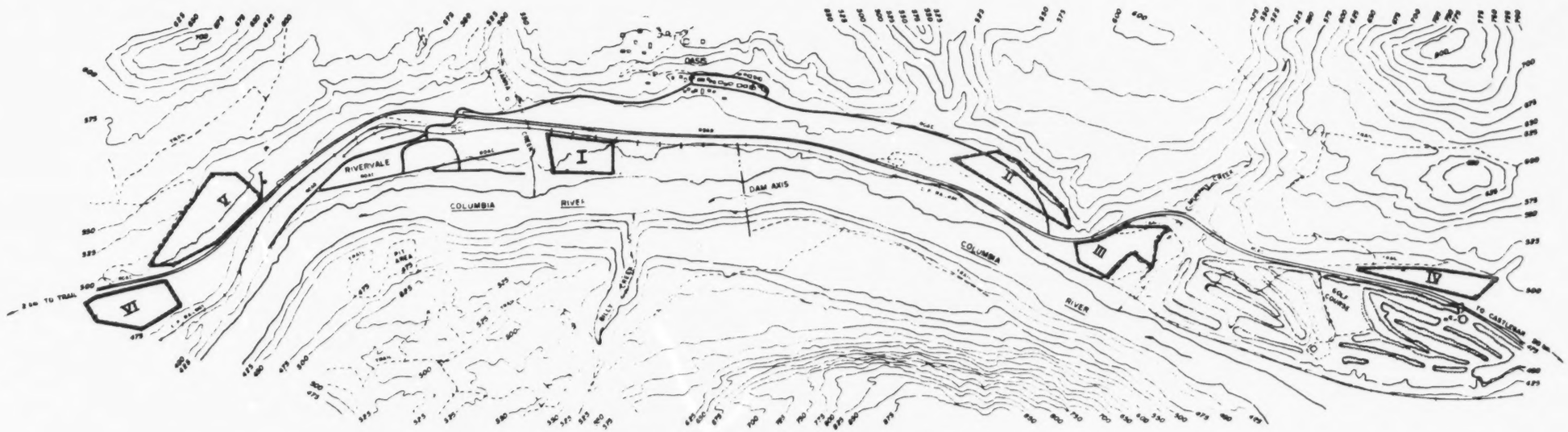
Item	Facilities to be Included	No. of Buildings	Total Floor Area/Space (m^2)	Special Features	Type of Construction
Offices	(i) Ex-7.M.P. 22 individual offices general office washrooms & furnace rooms	1	662	-	Prefabricated modular
	(ii) Duplicate space	1	662		
Columbia Hydro Constructors' Office	3 individual offices, general office and washrooms	1	174	Attached to kitchen/ dining complex	Prefabricated modular

Abbreviations: B.C. & Y.HJ.T.A. - British Columbia & Yukon Joint Trades Agreement
7.M.P. - Seven Mile Project

TABLE 3-2

PRELIMINARY COST OF CAMP DEVELOPMENT
($ SEPTEMBER 1982)

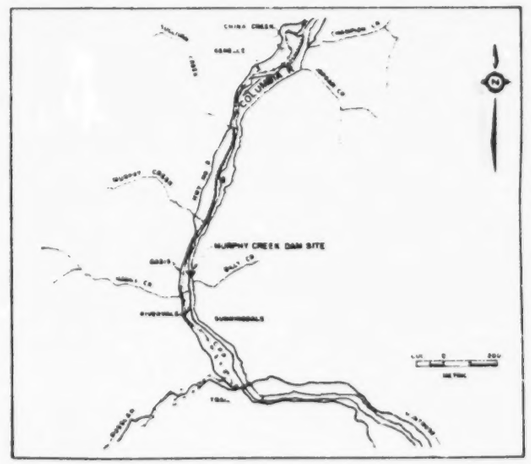
Item	Description	Cost Estimate
Off-site Servicing Costs	Water Supply	$ 525,000.
	Sewage Treatment System	200,000.
		$ 725,000.
Site Preparation Costs	Clear and Grub	$ 66,000.
	Remove Topsoil	67,000.
	Grading	176,000.
	Rail Crossing	20,000.
		$ 329,000.
On-Site Servicing Costs	Sanitary Sewers	$ 63,000.
	Storm Sewers	52,000.
	Water Supply	65,000.
	Paving and Parking	158,000.
	Electrical Distribution	183,000.
	Lighting	20,000.
	Telephone - site linework	12,000.
	- 50 pr. cable	70,000.
	Gas Distribution	8,000.
	Cable TV	39,000.
		$ 670,000.
Buildings	Foundations	$ 48,000.
	Supply & Erect:	
	Bunkhouses (2-storey)	4,152,000.
	Kitchen (re-used)	375,000.
	Offices (one re-used	71,000.
	one new)	288,000.
	Recreation Hall	147,000.
	Walkways, etc.	54,000.
		$5,135,000.
Landscaping	Topsoil and Seed	$ 30,000.
	Additional Planting	11,000.
		$ 41,000.
DIRECT CONSTRUCTION COST		$6,900,000.



Scale: 0 500 1000 Metres

SITE STATISTICS

SITE I		SITE II		SITE III		SITE IV		SITE V		SITE VI	
SITE AREA	4.9 ha	SITE AREA (TOTAL)	6.1 ha	SITE AREA	5.33 ha	SITE AREA	4.9 ha	SITE AREA	6.88 ha	SITE AREA	5.0 ha (approx.)
TRAVEL DISTANCE	0.5 km	TRAVEL DISTANCE	1.5 km	TRAVEL DISTANCE	1.8 km	TRAVEL DISTANCE	3.1 km	TRAVEL DISTANCE	2.2 km	TRAVEL DISTANCE	2.4 km
GRADE	4 - 7 %	GRADE	3 - 13 %	GRADE	5% (approx.)	GRADE	0 - 5 %	GRADE	12 - 20 %	GRADE	< 10 - 27 %
TERRAIN	GRAVEL TERRACE	TERRAIN	GRAVEL TERRACE ROCK ADJACENT	TERRAIN	GRAVEL TERRACE	TERRAIN	GRAVEL TERRACE	TERRAIN	ROCK OUTCROPPING	TERRAIN	ROCK OUTCROPPING % GRAVEL
ASPECT	EAST	ASPECT	SOUTH EAST	ASPECT	EAST	ASPECT	SOUTH EAST	ASPECT	NORTH EAST	ASPECT	SOUTH EAST



KEY PLAN

DRAWING REDUCED

A	SITE V REDUCED IN SIZE	MAR '82
No.	REVISION	DATE

CLIENT B.C. HYDRO & POWER AUTHORITY

PROJECT MURPHY CREEK PROJECT
CAMP & OFFICE DEVELOPMENT STUDY

Bowman Engineering Associates Limited
Consulting Engineers
Vancouver, B.C. 669 - 0814

TITLE
SITES LOCATION PLAN

DESIGN	
DRAWN M.L.	DRAWING No. 20.1 - A
CHECKED	
DATE MARCH, 1982	
SCALES AS SHOWN	SHT.
SEAL	REVISION No. A

CANADIAN PACIFIC RAILWAY

HIGHWAY 99

BUNKHOUSE Nº 1
EL. 429.70

BUNKHOUSE Nº 2
EL. 429.70

BUNKHOUSE Nº 3
EL. 427.70

BUNKHOUSE Nº 4
EL. 429.20

BUNKHOUSE Nº 5
EL. 426.70

BUNKHOUSE Nº 6
EL. 426.70

BUNKHOUSE Nº 7 (PHASE II)
EL. 424.70

BUNKHOUSE Nº 8 (PHASE II)
EL. 425.70

KITCHEN

DINING

VESTIBULE

(PHASE II)

C.H.C. OFFICE

RECREATION HALL

(PHASE I)

(PHASE II)

PARKING (30)

OFFICE

OFFICE

MURPHY CREEK

300m RANGE (UNDEVELOPED)

DEAD AREA DUE TO RAISED WATER LEVEL

COLUMBIA RIVER

CLIENT B.C. HYDRO AND PO

PROJECT MURPHY CREE

HIGHWAY 22

HIGHWAY 22

HIGHWAY RELOCATION

CANADIAN PACIFIC RAILWAY

BY-ROAD

RAILWAY DIVERSION

BY-ROAD

POWERHOUSE ACCESS ROAD

DINING

VESTIBULE

C.H.C. OFFICE

BY-ROAD

BY-ROAD

COLUMBIA RIVER

LEGEND

- ROAD AND PARKING AREAS
- BUILDING
- PROPOSED CONTOURS
- EXISTING CONTOURS
- TREED AREA
- RAILWAY
- PROPOSED ROAD (ELEVATIONS)

DRAWING REDUCED

CLIENT B.C. HYDRO AND POWER AUTHORITY
BOX 12121 - 970 W HASTINGS STREET, VANCOUVER, B.C. V6B 4T6

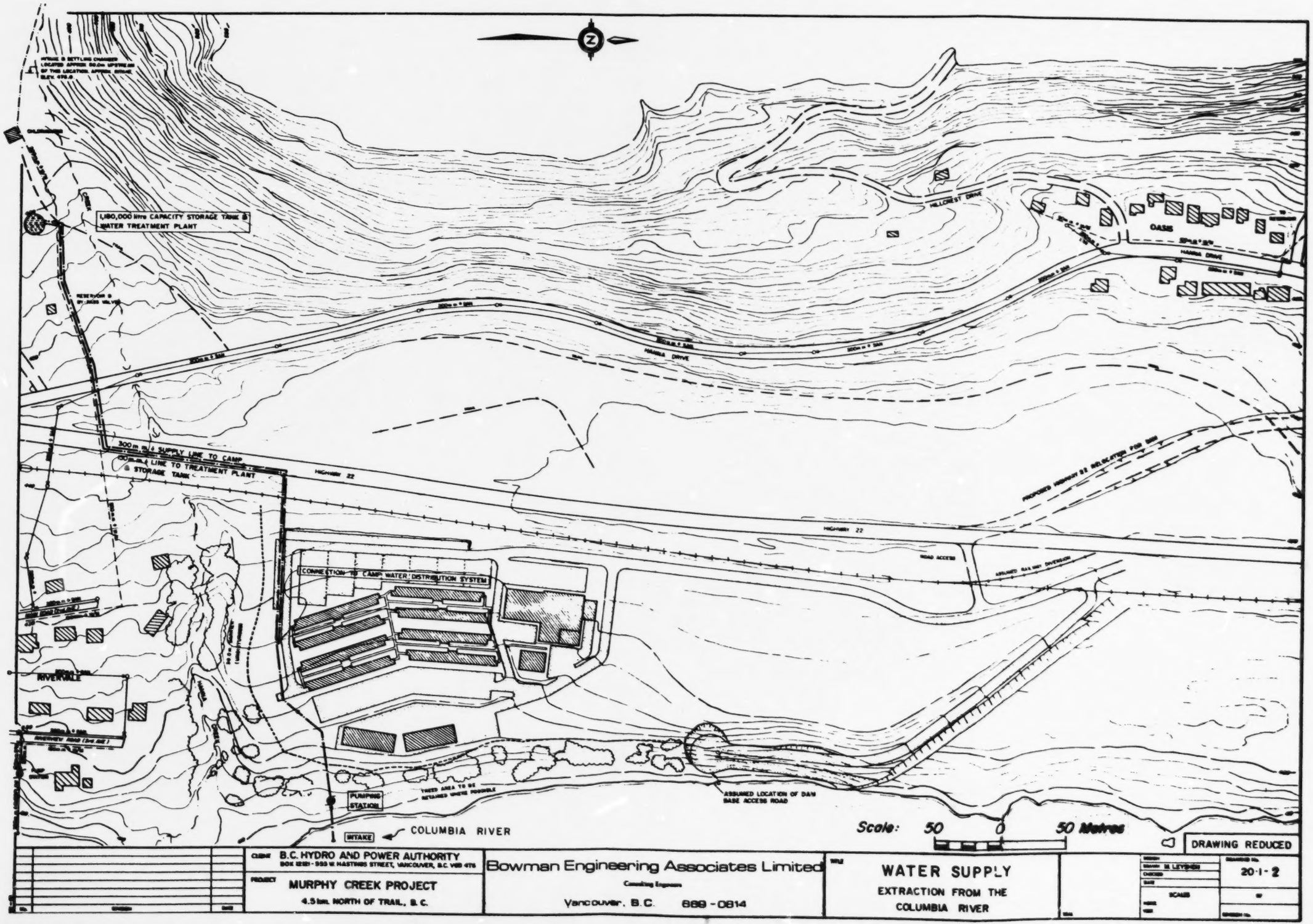
PROJECT MURPHY CREEK PROJECT
4.5km NORTH OF TRAIL, B.C.

Bowman Engineering Associates Limited
Consulting Engineers
Vancouver, B.C. 669 - 0814

TITLE SITE LAYOUT & GRADING

DRAWN M. LEVINSON
DATE SEPTEMBER, 1982
SCALE

DRAWING No. 20-1-1



CLIENT B.C. HYDRO AND POWER AUTHORITY
BOX 12121 - 555 W. HASTINGS STREET, VANCOUVER, B.C. V6B 4T6

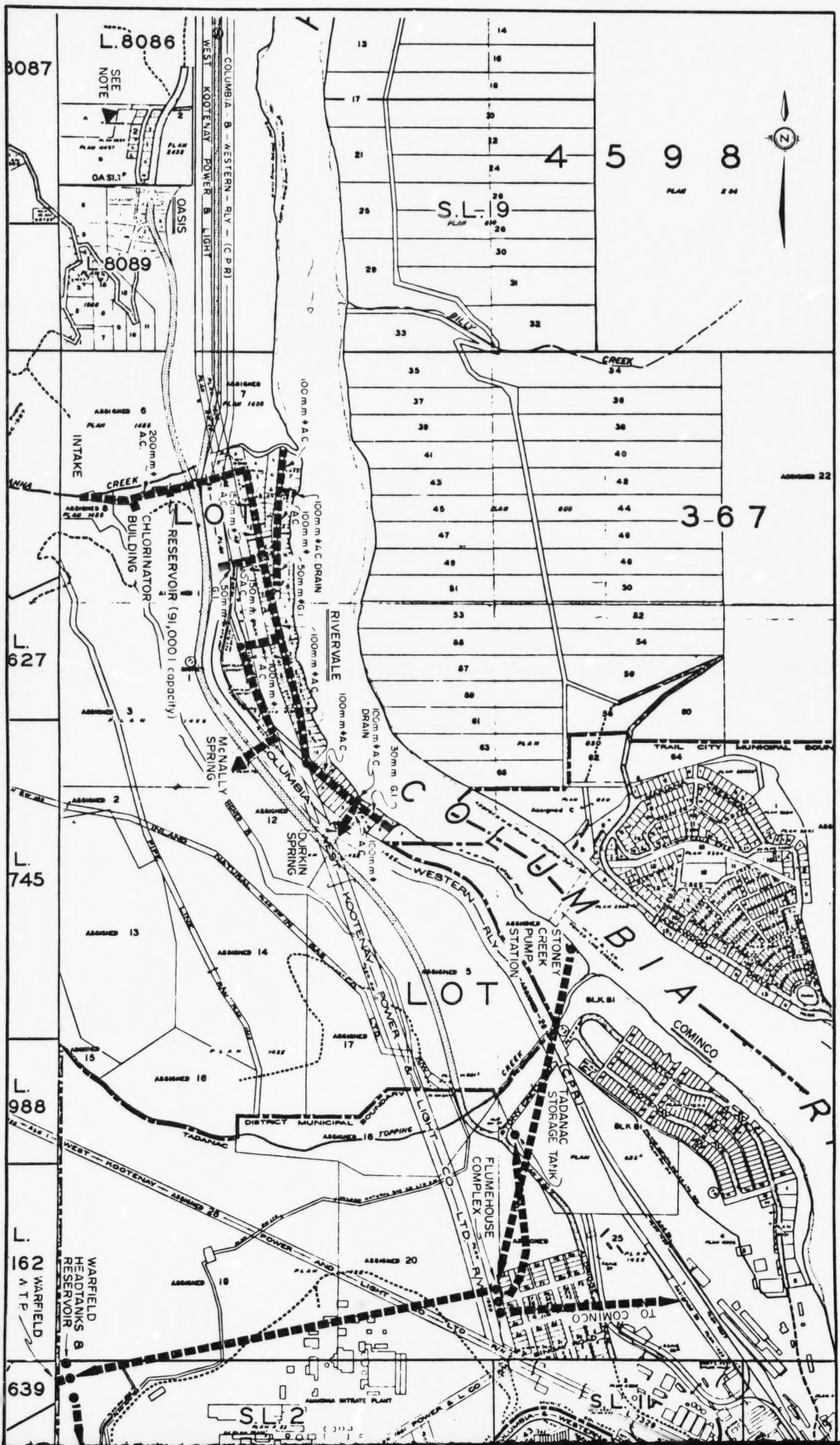
PROJECT MURPHY CREEK PROJECT
4.5 km. NORTH OF TRAIL, B.C.

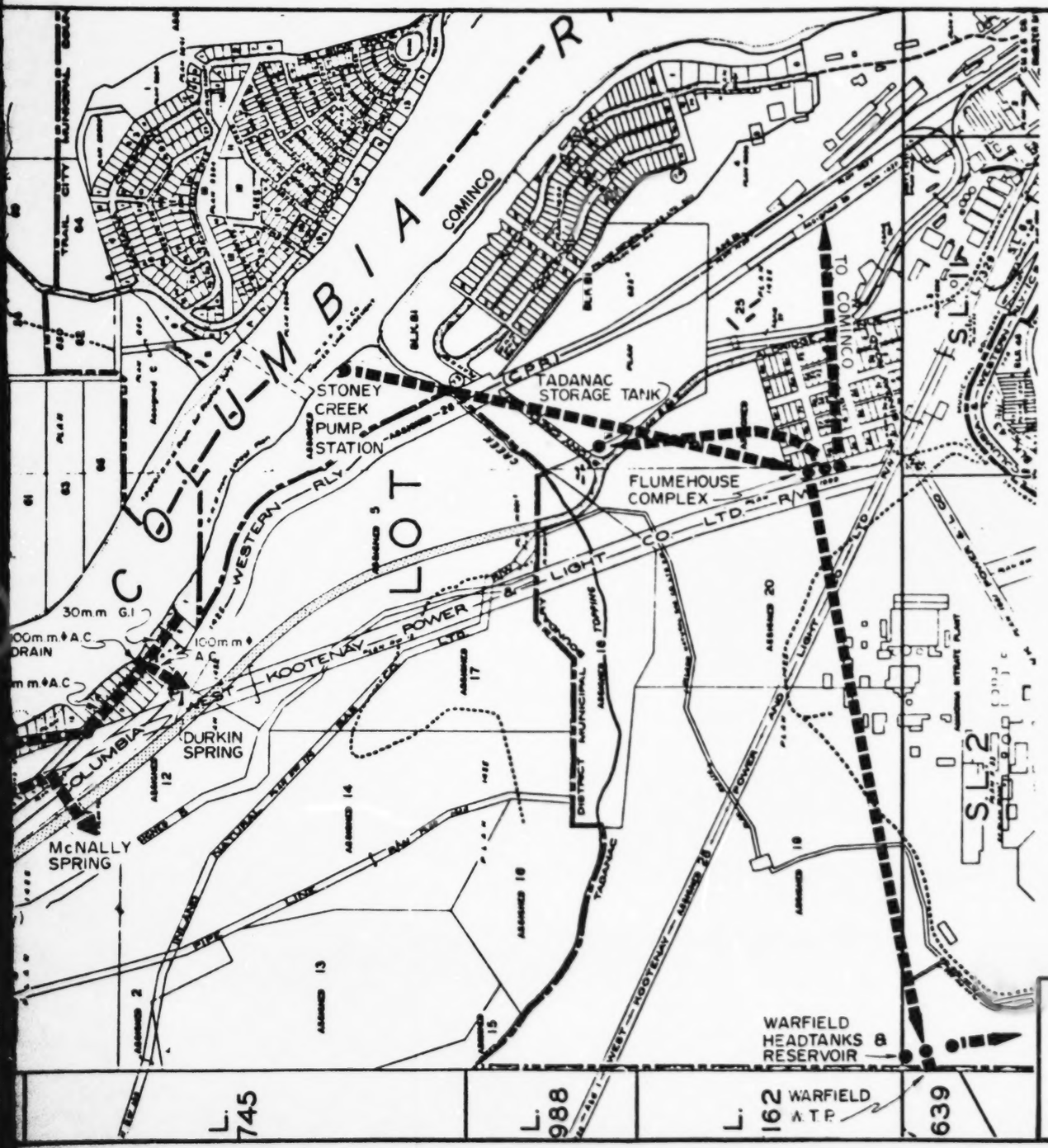
Bowman Engineering Associates Limited
Consulting Engineers
Vancouver, B.C. 689-0814

TITLE WATER SUPPLY
EXTRACTION FROM THE
COLUMBIA RIVER

DESIGN M. LEYSHON
CHECKED
DATE
SCALES

DRAWING No. 20-1-2


L.8086
SEE NOTE
8087
COLUMBIA - WESTERN - RLY - (C P R)
WEST KOOTENAY POWER & LIGHT
OASIS
L.8089
4598
S.L.19
3-67
INTAKE
CREEK
BUILDING
CHLORINATOR
RESERVOIR (91,000 I capacity)
RIVERVALE
McNALLY SPRING
DURKIN SPRING
COLUMBIA
WESTERN RLY
STONEY CREEK PUMP STATION
LOT
COMINCO
TADANAC STORAGE TANK
FLUMEHOUSE COMPLEX
WEST KOOTENAY POWER & LIGHT CO LTD
TADANAC
DISTRICT MUNICIPAL BOUNDARY
TRAIL CITY MUNICIPAL BOUN
WARFIELD HEADTANKS & RESERVOIR
L. 627
L. 745
L. 988
L. 162
639
S.L.2
S.L.1



900 0 900 1800 2700

SCALE IN FEET

NOTE:

OASIS WATER SUPPLY

5 ARTESIAN WELLS FEED A 54,500 litre CONCRETE STORAGE TANK. A 100m m ♦ MAIN CONVEYS THE WATER THROUGH THE COMMUNITY.

EXISTING WATERWORKS SYSTEMS

DRAWING REDUCED

Bowman Engineering Associates Limited
Consulting Engineers
Vancouver B C 669-0814

DWG NO 20-1-3

N

4598

3-67

S.L.-19

S.L.-14

S.L.-2

COLUMBIA

COMINCO

TO COMINCO

CPR

TADANAC STORAGE TANK

STONEY CREEK PUMP STATION

WESTERN RLY

FLUMEHOUSE COMPLEX

150mm ϕ PROP CONNECTION FROM TADANAC TO RIVERVALE SYSTEM

KOOTENAY POWER & LIGHT CO LTD R/W

50mm ϕ G.I.

100mm ϕ A.C. DRAIN

100mm ϕ A.C.

RIVERVALE

100mm ϕ A.C. DRAIN

100mm ϕ A.C.

150mm ϕ A.C.

DURKIN SPRING

COLUMBIA

COLUMBIA & WESTERN RLY. (C.P.R.)

WEST KOOTENAY POWER & LIGHT

McNALLY SPRING

OASIS

PROP 300mm ϕ SUPPLY LINE TO CAMP

RESERVOIR (91,000 litre capacity)

200mm ϕ A.C.

CHLORINATOR BUILDING

PROPOSED 1,180,000 litre CAPACITY STORAGE TANK

L.8086

SEE NOTE

8089

INTAKE

8087

L. 627

L. 745

L. 988

L. 162

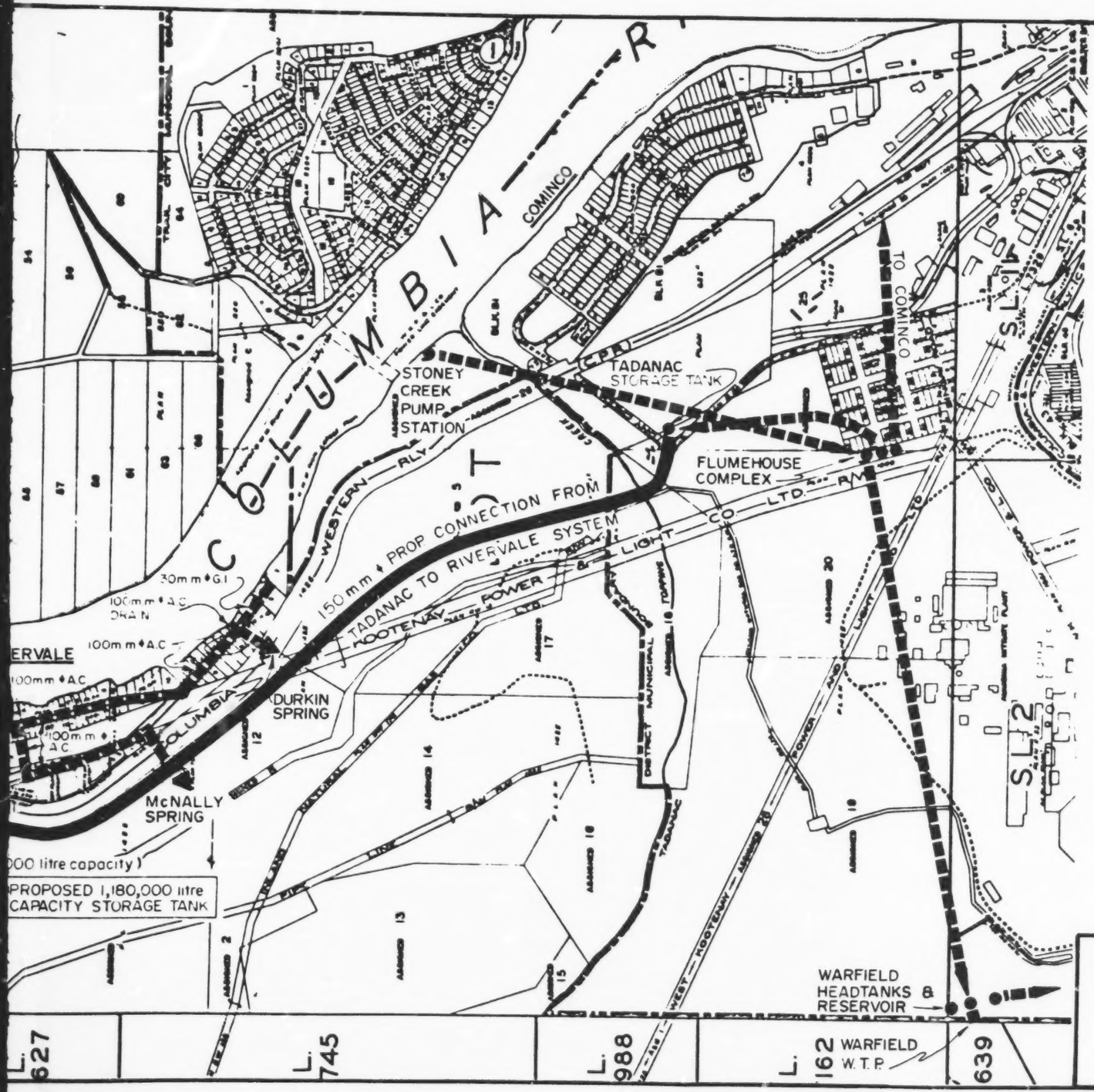
WARFIELD W.T.P.

639

WARFIELD HEADTANKS & RESERVOIR

DISTRICT MUNICIPAL BOUNDARY

WEST KOOTENAY POWER & LIGHT CO LTD R/W



900 0 900 1800 2700

SCALE IN FEET

NOTE:

OASIS WATER SUPPLY

5 ARTESIAN WELLS FEED A 54,500 litre CONCRETE STORAGE TANK. A 100 m m ♦ MAIN CONVEYS THE WATER THROUGH THE COMMUNITY.

ALTERNATIVE WATER SUPPLY

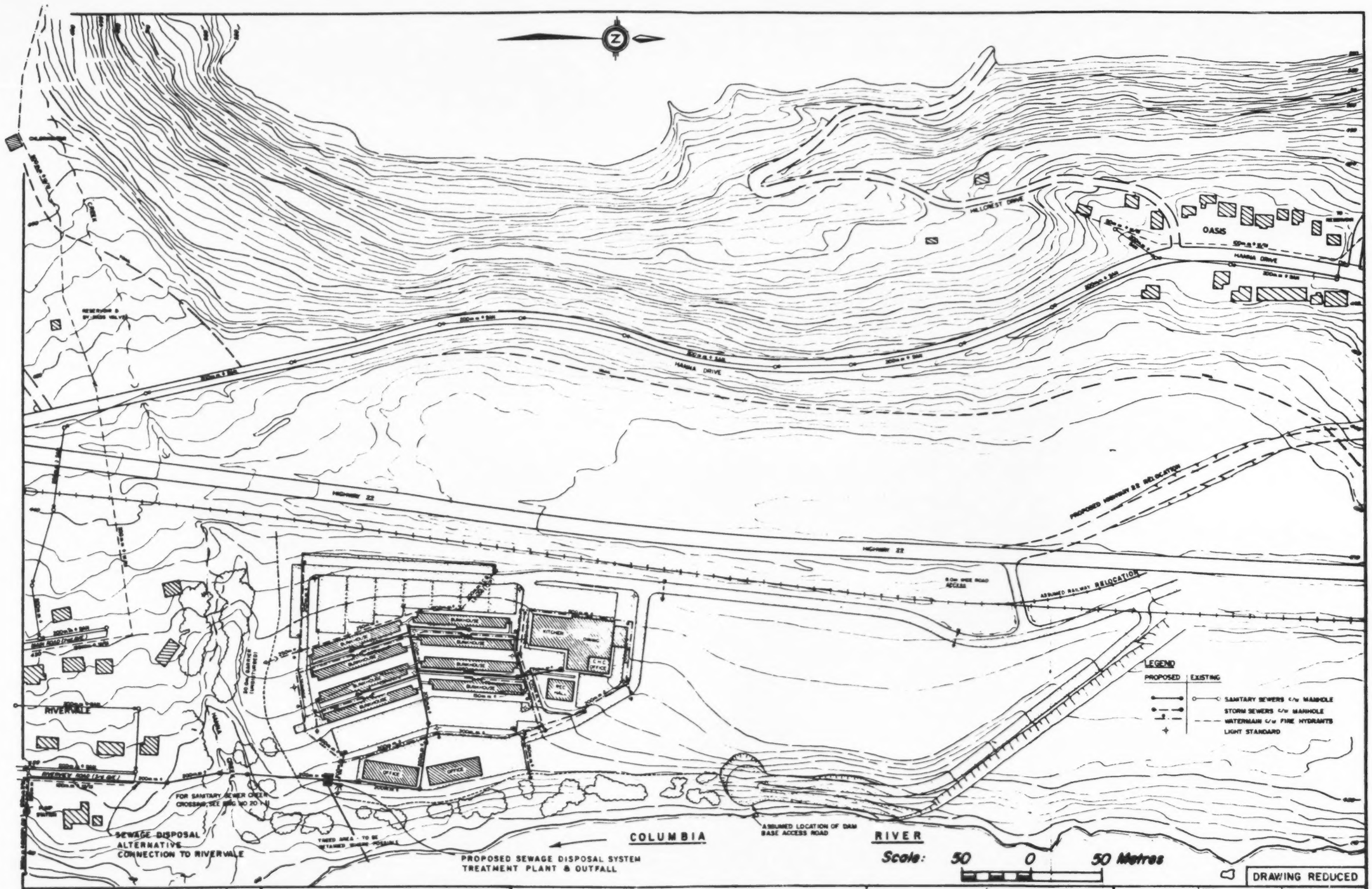
Bowman Engineering Associates Limited

Consulting Engineers

Vancouver B.C. 669-0814

DWG. NO. 20·1-4

DRAWING REDUCED



CLIENT B.C. HYDRO AND POWER AUTHORITY
BOX 12121 - 555 W HASTINGS STREET, VANCOUVER, B.C. V6B 4T6

PROJECT MURPHY CREEK PROJECT
4.5km NORTH OF TRAIL, B.C.

Bowman Engineering Associates Limited
Consulting Engineers
Vancouver, B.C. 689-0814

TITLE SEWAGE DISPOSAL

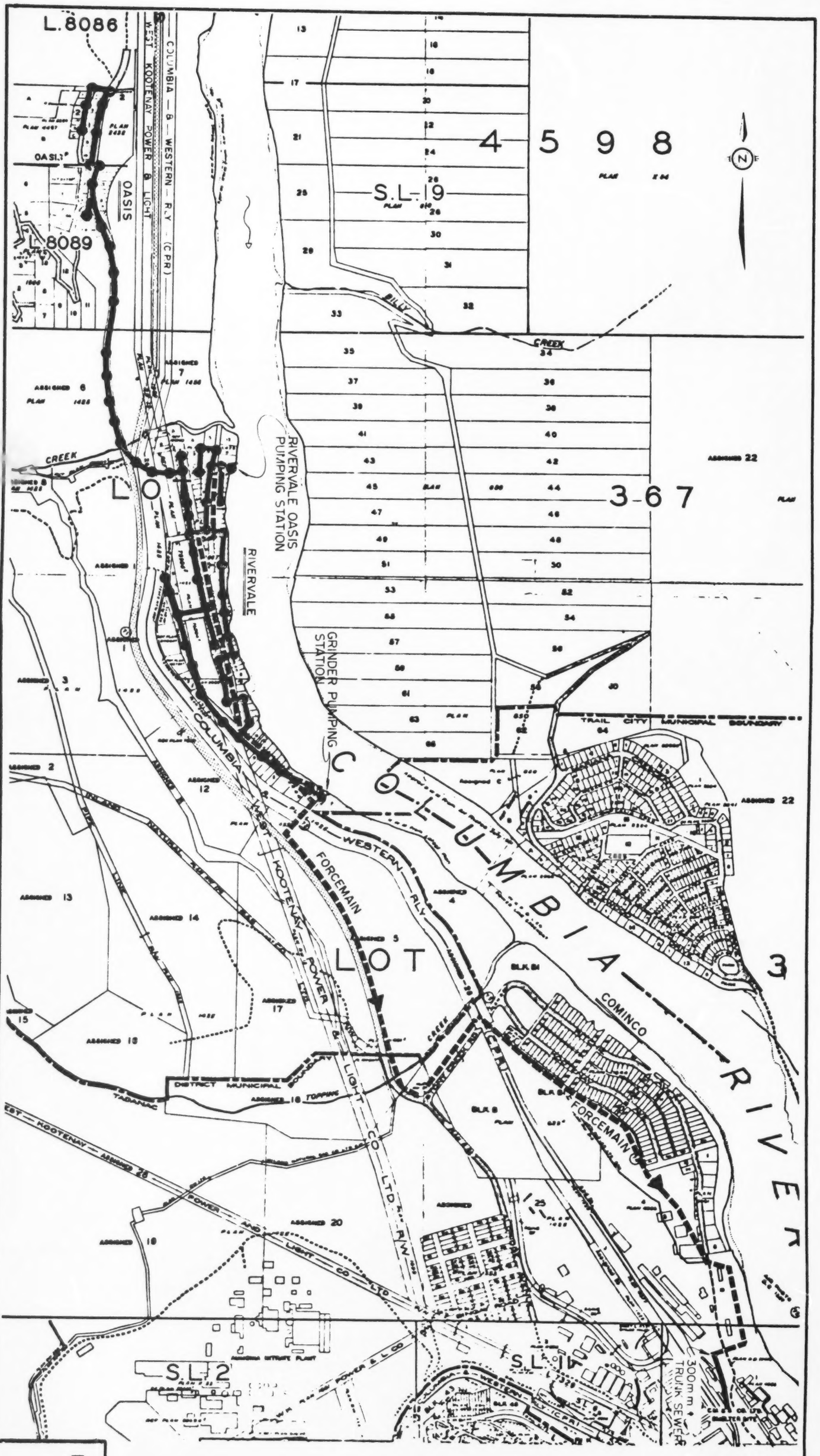
DESIGN
DRAWN M LEYSHON
CHECKED
DATE

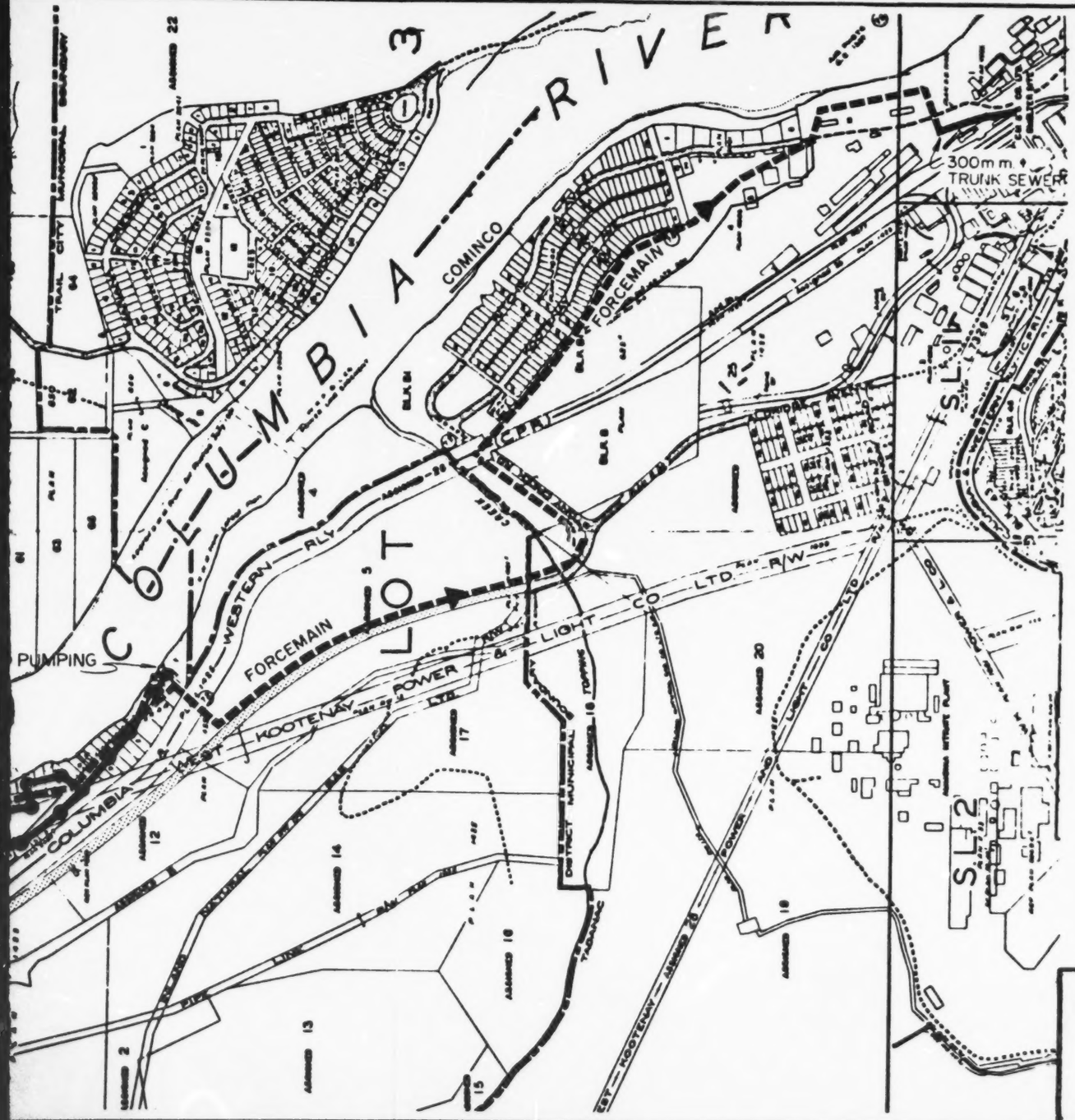
DRAWING No. 20-1-5

SCALES AS SHOWN

SHEET No. 9 of 15

REVISION No.


L.8086
L.8089
OASIS
COLUMBIA — & — WESTERN — R.Y. — (C.P.R.)
WEST KOOTENAY POWER & LIGHT
4 5 9 8
S.L. 19
RILLY
CREEK
RIVERVALE OASIS PUMPING STATION
RIVERVALE
GRINDER PUMPING STATION
3-6 7
TRAIL CITY MUNICIPAL BOUNDARY
COLUMBIA RIVER
WESTERN RLY
FORCEMAIN
LOT
COMINCO
FORCEMAIN
DISTRICT MUNICIPAL
TADANAC
TOPPING
CO LTD R/W
S.L. 12
S.L. 17
300mm TRUNK SEWER



900 0 900 1800 2700

SCALE IN FEET

LEGEND

- EXISTING SANITARY SEWER
- EXISTING FORCEMAIN
- MANHOLE

EXISTING RIVERVALE OASIS SANITARY SEWER SYSTEM

DRAWING REDUCED

Bowman Engineering Associates Limited

Consulting Engineers

Vancouver, B.C 669-0814

DWG. NO. 20-1-6

CANADIAN PACIFIC RAILWAY

MAIN H.V. DISCONNECT & GROUND

OVERHEAD LINE

BUNKHOUSE Nº 1

BUNKHOUSE Nº 2

BUNKHOUSE Nº 3

BUNKHOUSE Nº 4

BUNKHOUSE Nº 5

BUNKHOUSE Nº 6

BUNKHOUSE Nº 7

BUNKHOUSE Nº 8

400 AMPS

500 KVA PAD MOUNTED KIOSK

KITCHEN

DINING

VESTIBULE

C.H.C. OFFICE

200 AMPS

RECREATION HALL

OFFICE

OFFICE

HIGH VOLTAGE LOAD BREAK SWITCH TO B.C. HYDRO UTILITY CO. STANDARDS

7200 V. Δ OR 12000 V.

PRIMARY METERING

HIGH VOLTAGE OVERHEAD LINE & POLES

SINGLE

WUMBA CREEK

CLIENT B.C. HYDRO AN

PROJECT MURPHY CR

HIGHWAY 22

HIGHWAY 22

HIGHWAY 22 RELOCATION

DINING

VESTIBULE

C HC OFFICE

HIGH VOLTAGE LOAD BREAK SWITCH TO B C HYDRO STANDARDS

7200 V Δ OR 12000 V

PRIMARY METERING

HIGH VOLTAGE OVERHEAD LINE & POLES

TYPICAL 500 KVA 3Ø SUBSTATION TYPICAL UNDERGROUND SUB FEED TO BUILDING 120/208V/3Ø 4W - AMPERAGE TO SUIT LOAD

UNDERGROUND HIGH VOLTAGE LINE

SINGLE LINE DIAGRAM

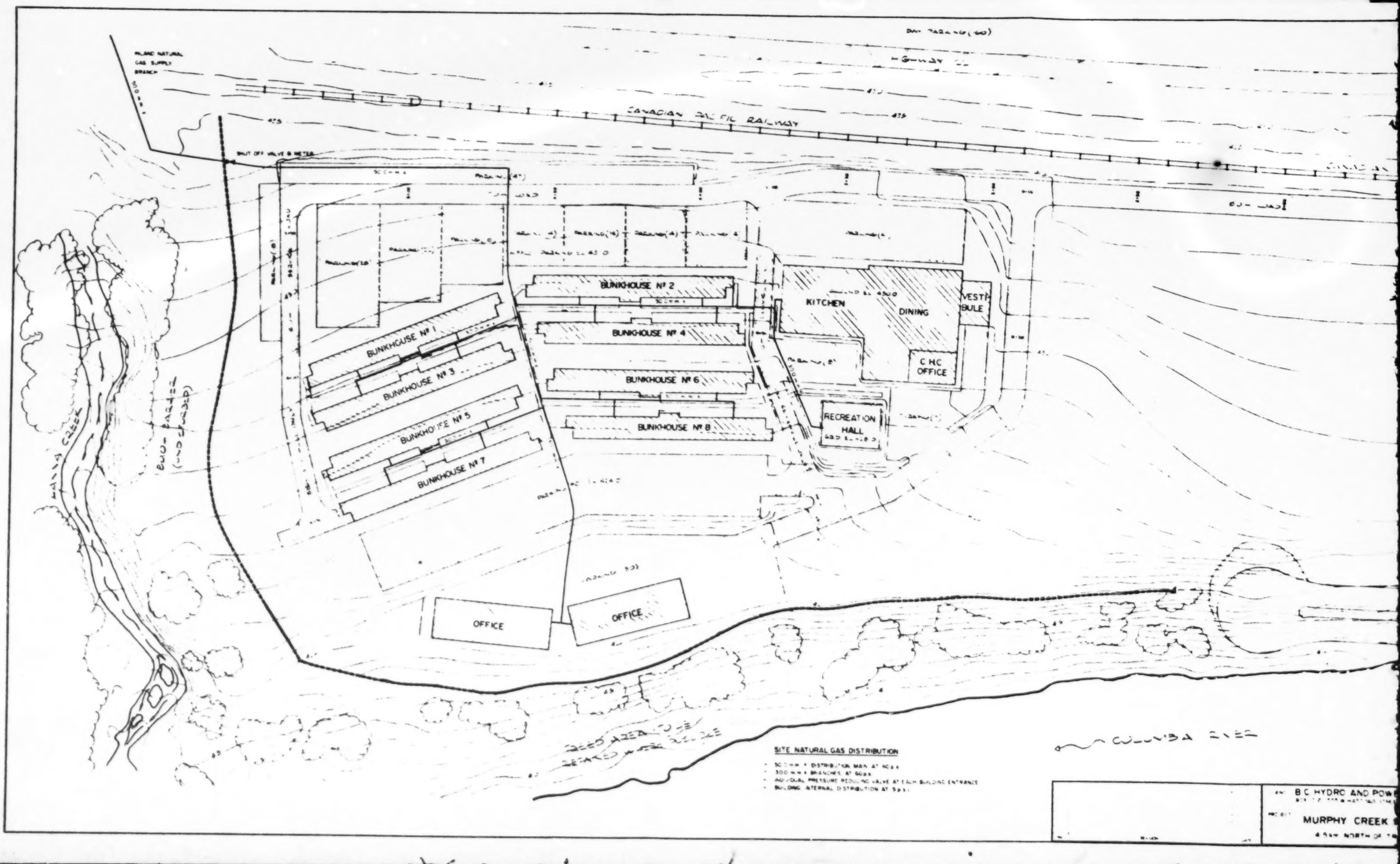
LEGEND

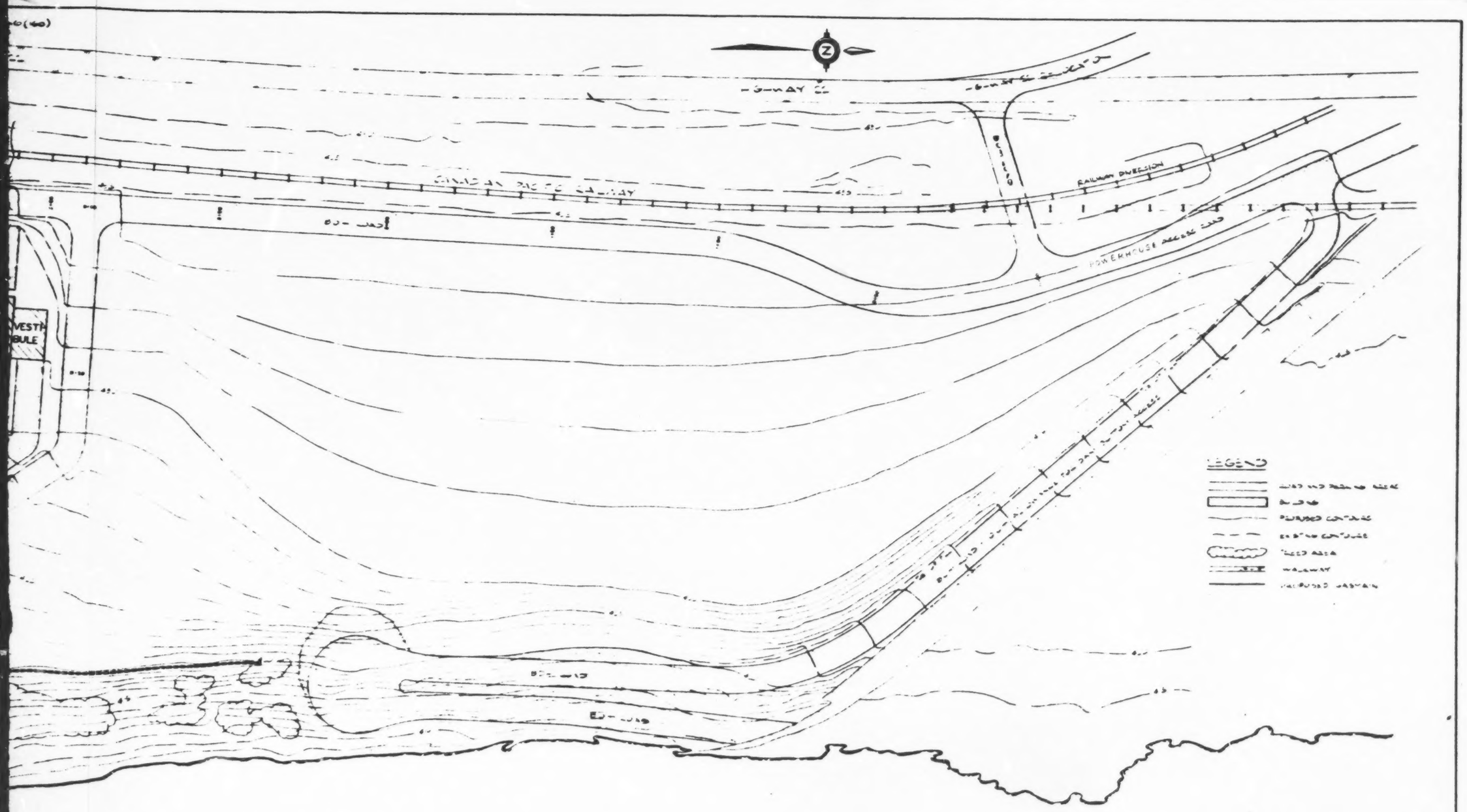
WILDA CREEK

Scale: 20 0 20 Metres

DRAWING REDUCED

	B C HYDRO AND POWER AUTHORITY MURPHY CREEK PROJECT 4.5km NORTH OF TRAIL, B C	Bowman Engineering Associates Limited Vancouver B C 669-0814	POWER DISTRIBUTION & STREET LIGHTING	20 1-7


CANADIAN PACIFIC RAILWAY
BUNKHOUSE Nº 1
BUNKHOUSE Nº 2
BUNKHOUSE Nº 3
BUNKHOUSE Nº 4
BUNKHOUSE Nº 5
BUNKHOUSE Nº 6
BUNKHOUSE Nº 7
BUNKHOUSE Nº 8
KITCHEN
DINING
C.H.C. OFFICE
RECREATION HALL
OFFICE
OFFICE
SITE NATURAL GAS DISTRIBUTION
B.C. HYDRO AND POW
MURPHY CREEK



DRAWING REDUCED

B C HYDRO AND POWER AUTHORITY

MURPHY CREEK PROJECT

4.5km NORTH OF TRAIL, B C

Bowman Engineering Associates Limited

Consulting Engineers

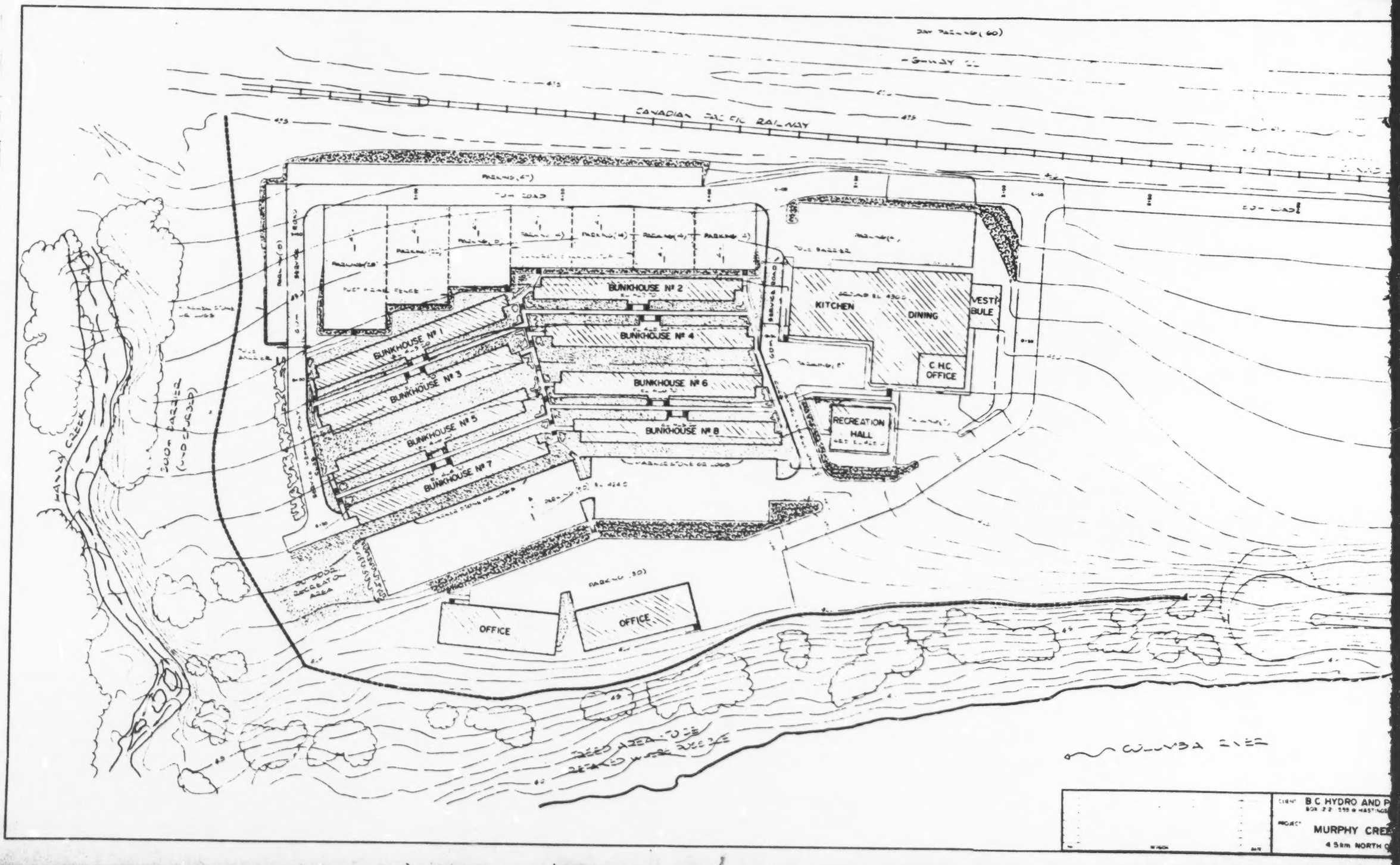
Vancouver B C 669 - 0814

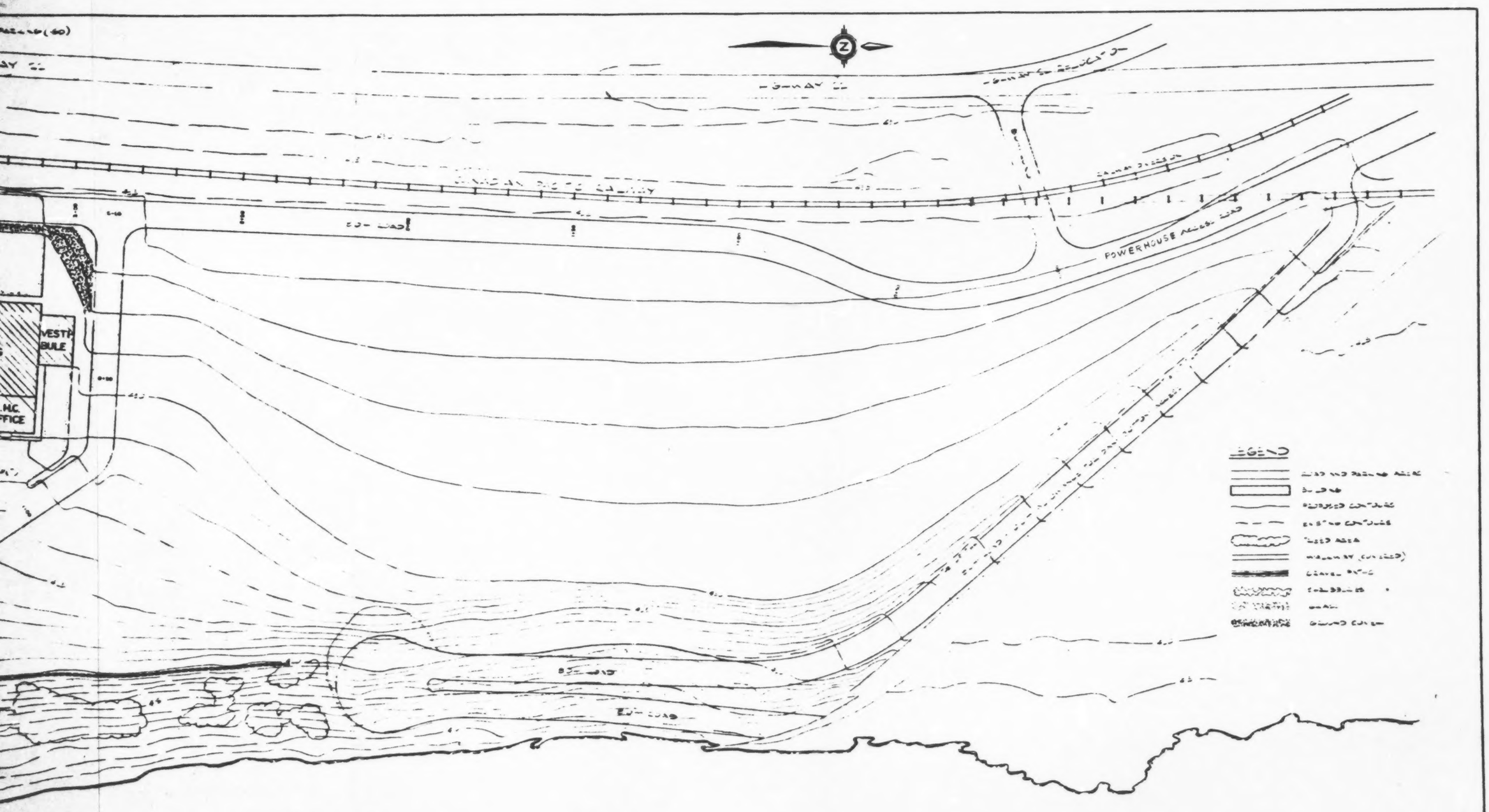
NATURAL GAS DISTRIBUTION

SEPTEMBER, 1982

SCALES

20 | 8


CANADIAN PACIFIC RAILWAY
PARKING (47)
TURN ROAD
BUNKHOUSE Nº 1
BUNKHOUSE Nº 2
BUNKHOUSE Nº 3
BUNKHOUSE Nº 4
BUNKHOUSE Nº 5
BUNKHOUSE Nº 6
BUNKHOUSE Nº 7
BUNKHOUSE Nº 8
KITCHEN
DINING
VESTIBULE
C.H.C. OFFICE
RECREATION HALL
SERVICE ROAD
OFFICE
OFFICE
PARKING (30)
PLAYGROUND AREA
WUMBA CREEK
B.C. HYDRO AND P
MURPHY CREE



DRAWING REDUCED

	CLIENT B C HYDRO AND POWER AUTHORITY BOX 12 2 555 @ HASTINGS STREET, VANCOUVER, B C V6B 4T6 PROJECT MURPHY CREEK PROJECT 4.5km NORTH OF TRAIL, B C	Bowman Engineering Associates Limited Consulting Engineers Vancouver B C 669 - 0814	TITLE LANDSCAPE PROPOSAL		DRAWN M LEYSHON DATE SEPTEMBER, 1982 SCALES DRAWING No 20 1 - 9

POOR
QUALITY
ORIGINAL